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THE

MARINE BIOLOGICAL STATION AT PORT ERIN

(Isle of Man),

BEING THE

THIRTY-THIRD ANNUAL REPORT

OF THE

LIVERPOOL MARINE BIOLOGY COMMITTEE.

DRAWN UP BY

W. A. HERDMAN, D.Sc., LL.D., For. Sec. R.S.,
Hon. D.Sc. (Harvard, Durham, Sydney, and W. Austr.);

PAST-PRESIDENT OF THE ISLE OF MAN NATURAL HISTORY AND ANTIQUARIAN SOCIETY,
AND OF THE LINNEAN SOCIETY OF LONDON AND PRESIDENT-ELECT OF
THE BRITISH ASSOCIATION;
PROFESSOR OF OCEANOGRAPHY IN THE UNIVERSITY OF LIVERPOOL;
CHAIRMAN OF THE LIVERPOOL MARINE BIOLOGY COMMITTEE,
AND DIRECTOR OF THE PORT ERIN STATION.

ALONG WITH A SHORT SUMMARY OF

THE HISTORY AND WORK OF THE L.M.B.C.

[Read before the Liverpool Biological Society, November 14th, 1919]

LIVERPOOL
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December, 1919.

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Liverpool Marine Biology Committee.

Executive.

Chairman and Honorary Director of the Laboratory:

PROFESSOR W. A. HERDMAN, D.Sc., F.R.S.,
University, Liverpool.

Honorary Treasurer:

MR. EDWIN THOMPSON, C.C., 13, Fulwood Park, Liverpool.

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Curator of the Biological Station:

MR. H. C. CHADWICK, A.L.S., Port Erin.

Assistant:

MR. T. N. CREGEEN.

Former Members of the Committee:

THE LATE RT. HON. SIR JOHN T. BRUNNER, BART.
THE LATE MR. R. D. DARBISHIRE.
THE LATE LORD HENNIKER.
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THE LATE SIR SPENCER WALPOLE, K.C.B.
DR. W. EVANS HOYLE.
MR. JOHN VICARS.

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MARINE BIOLOGICAL STATION AT PORT ERIN

BEING THE

THIRTY-THIRD ANNUAL REPORT

OF THE

LIVERPOOL MARINE BIOLOGY COMMITTEE.

By Professor W. A. Herdman, F.R.S.

This is the final Report of the Liverpool Marine Biology Committee; but not, it is hoped, of the Port Erin Biological Station and the work in marine biology and fisheries research which has been carried on during the past thirty-five years in the Liverpool district. As a consequence of the establishment of a department and endowed Chair of Oceanography in the University of Liverpool the Committee has decided to transfer its work, responsibilities and assets to that department of the University as from December 31st, 1919.* This does not mean that any change—save happily for the better—need be made in the direction or the conduct of the scientific work. The establishment of the Professorship of Oceanography in the University is intended to consolidate and perpetuate the local marine biological and other oceanographic investigations and their application to sea-fisheries research. The Council of the University has invited me to occupy the Chair of Oceanography for the first year, from October, 1919, after which period of reconstruction and arrangement I shall gladly resign the Professorship into the competent hands of my colleague, Dr. James Johnstone, who has for so many years been associated with the scientific work of the Lancashire Sea-Fisheries. It is the earnest hope of the founders of the Chair that the work

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* The minutes of the Meeting of the Committee at which this important decision was arrived at will be found in the Treasurer's Report on p. 79.

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of the Port Erin Biological Station and the scientific investigations of the Lancashire and Western Sea-Fisheries Committee may for the future be united under the Oceanographic Department of the University, and that this union may conduce to the advancement of our knowledge of the sea and its products, and the promotion of the local fishing industries.

The recovery in numbers at the Biological Station is remarkable. In 1914, we recorded ninety researchers and students occupying work-places in the laboratory and 12,000 visitors to the Aquarium. In 1918 we had 16 workers in the laboratory and over 7,600 visitors to the Aquarium. This year (1919) the Curator's report shows over 60 laboratory workers and over 23,000 visitors—a number far beyond our highest pre-war record of 16,000.

The work of the staff at the Biological Station has been carried on as usual, and large collections of the plankton in the bay have been made throughout the year.

As on previous occasions the statistics as to the use made of the institution throughout the year will be given in the form of a " Curator's Report " (see below).

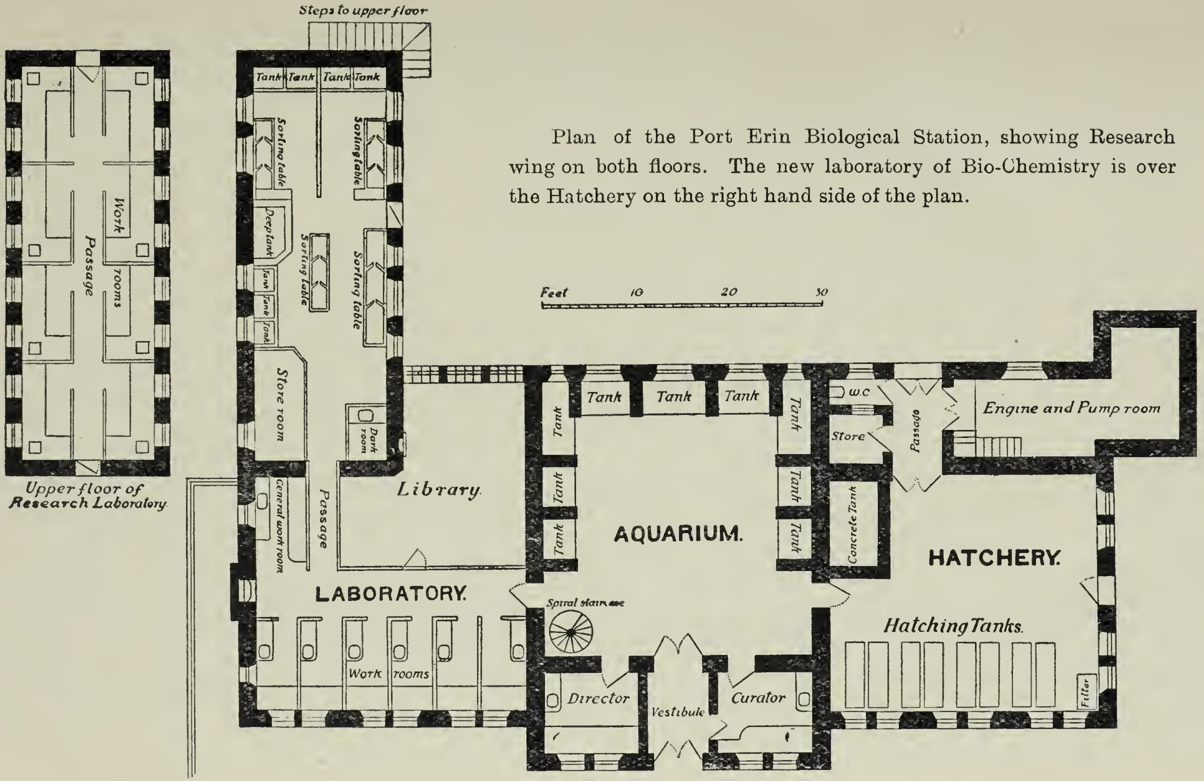
It may be useful to those proposing to work at the Biological Station that the ground plan of the buildings, showing the laboratory and other accommodation, should be inserted in this Report as on previous occasions (see p. 5).

CURATOR'S REPORT.

Mr. Chadwick reports to me as follows on the various departments of the work at the Station during 1919 :—

Station Record.

" Sixty-six workers occupied our laboratories during the past year, the majority being undergraduates from the Departments of Zoology and Botany of the University of Liverpool. The University of Manchester and University College, Reading,



Plan of the Port Erin Biological Station, showing Research wing on both floors. The new laboratory of Bio-Chemistry is over the Hatchery on the right hand side of the plan.

also sent contingents ; and in the daily round of shore collecting, tow-netting and microscopical examination in the laboratory much good work was done during the Easter vacation, under the direction of Professor Herdman, Miss R. C. Bamber and Miss Blackwell.

" An important research into the seasonal variation in the alkalinity of sea-water was conducted by Professor B. Moore, who with his son, Mr. T. Moore, Mr. E. Whitley and Mr. T. A. Webster occupied the bio-chemical laboratory during the Easter vacation. They were followed in the work by Dr. G. B. R. Prideaux of University College, Nottingham, and the research was resumed and carried on for a fortnight in July by Mr. T. Moore and Mr. Webster. During the latter part of the Easter vacation Miss C. Mayne resumed her work on the animal ecology of Port Erin Bay ; and in July Mr. G. F. Sleggs, who succeeded Miss Mayne as Edward Forbes Exhibitioner, spent a fortnight in observing the habits and preserving specimens of the common barnacle, *Balanus balanoides*, with a view to the authorship of an L.M.B.C. Memoir upon that type. During the summer vacation Miss E. C. Herdman, of Newnham College, Cambridge, re-discovered the interesting Orthonectid *Rhopalura giardii* which occurs as a parasite in the body cavity of the brittle-starfish *Amphiura elegans*, and devoted much time and labour to the elucidation of its structure. At the same time Dr. H. E. Roaf occupied the bio-chemical laboratory and devoted himself to research on the CO_2 in sea-water under different conditions.

" Amongst a considerable number of anemones brought in by several fishermen from the local fishing grounds was one which was immediately recognised as probably new to our fauna. It had, unfortunately, been injured, probably by a fish-hook, and survived only a few days. Mr. T. A. Stephenson of University College, Aberystwyth, to whom it was sent, identified it as *Ilyanthus mitchellii*, a species not hitherto known to occur in the L.M.B.C. District. During a brief visit to Port Erin in September Mr. Stephenson detected on a water-worn stone brought in by a fisherman a few specimens of one of the smallest British anemones, *Edwardsia carnea.* This species was first recorded as a member of the marine fauna of the Isle of Man in 1906, but the specimens under notice are the only ones seen since that year.

" On August 27th a young grey seal (*Phoca vitulina*) was captured on the beach by one of the local fishermen and presented by him to the Institution. It measured 2 feet 10 inches over all. Placed in the large concrete tank in the Hatchery it attracted much attention. It was believed to have been thrown ashore by the waves during the prevalence of a summer storm in the early hours of the morning, and it is probable that it sustained some injury, for it survived capture only two days.

" A specimen of the nurse hound or large-spotted dog-fish (*Scyllium catulus*) measuring 3 feet 6 inches in length and weighing 12 lbs. was brought in alive on March 1st and lived a few days in one of our tanks. The occurrence of this fish in Manx waters has been previously recorded, but it is by no means common. Some of the Port Erin fishermen said they had not previously seen one. About the same time a lamprey (*Petromyzon marinus*) about 10 inches long was brought in. The fisherman who captured it said that while hauling one of his long lines he found it devouring a cod. The lamprey is another well-known fish the occurrence of which in Manx waters is rare.

List of Workers 1919.

Dec. 20*th*, 1918, *to Jan.* 2*nd*, 1919.
Professor Herdman.
Miss E. C. Herdman.

March 22*nd to April* 19*th.*
Professor Herdman.
Miss E. C. Herdman.
Miss R. H. Barker.

March 25*th to April* 7*th.*
Professor B. Moore.
Mr. T. Moore.
Mr. E. Whitley.
Mr. T. A. Webster.

March 26*th to April* 15*th.*
Professor F. J. Cole.
Miss N. B. Eales.
Mr. A. S. Wright.
Miss D. Freeman.
Miss G. M. Redfern.
Miss Trewavas.

March 30*th to April* 1*st.*
Dr. J. Johnstone.

March 31*st to April* 22*nd.*
Miss L. Thorpe.
Miss K. Berry.
Miss A. E. Chesters.
Miss O. Bangham.
Miss M. Bowen.
Miss R. C. Bamber.
Mr. G. F. Sleggs.
Miss B. E. Gilman.
Miss M. Hobbins.

April 4*th to* 10*th.*
Dr. G. B. R. Prideaux.

April 5*th to* 14*th.*
Dr. J. Stuart Thomson.
Miss E. Vernon.
Miss C. Rogers.
Miss E. Comstive.
Miss E. McGill.
Miss A. Dixon.
Miss M. Dixon.
Mrs. Baker

April 7*th to* 9*th.*
Miss M. Knight.

April 7*th to* 21*st.*
Miss E. M. Blackwell.
Miss R. Robbins.
Miss C. Mayne.
Miss M. A. Battersby.
Miss B. M. Baggs.
Miss G. Rutherford.
Miss E. A. Dodd.
Miss C. M. Jarvis.
Miss D. M. Atkin.
Miss H. Clarke.

April 12*th to* 19*th.*
Miss M. Critchley.
Miss K. Murray.
Miss A. Swindells.
Miss B. Atherton.
Miss E. Lewis.
Miss E. M. E. Gardiner.
Miss M. A. Pyke.
Miss D. Hookins.
Mr. J. G. Hamilton.

April 12*th to* 23*rd.*
Miss G. J. Stoddart.
Miss K. M. Stoddart.
Miss D. Stephenson.
Miss M. Holden.

April 14*th to* 30*th.*
Miss J. Graham.
Miss M. Simpson.
Miss J. Hilton.
Miss W. Kehoe.
Mr. R. W. Jones.
Miss E. L. Gleave.

April 25*th to May* 9*th.*
Dr. W. M. and Mrs. Tattersall.

July 7*th to* 21*st.*
Mr. T. Moore.
Mr. T. A. Webster.

July 11*th to* 23*rd.*
Mr. G. F. Sleggs.

July 14*th to* 30*th.*
Miss E. Vernon.

July 16*th to September* 28*th.*
Professor Herdman.
Miss E. C. Herdman.

July 30*th to September* 3*rd.*
Dr. H. E. Roaf.

September 3*rd to* 9*th.*
Mr. T. A. Stephenson.

Oct. 8*th to* 13*th and Dec.* 5*th to* 11*th.*
Miss M. Knight.

The Fish Hatchery.

" The stock of spawners which furnished the eggs hatched during the season of 1919 consisted of 62 survivors of the previous year's stock and 113 fish purchased from local fishermen, as they were caught, off Niarbyl, in September and October, 1918, making a total of 175 fish. Some loss occurred at the end of the year, probably owing to temporary failure of the supply of mussels for food, and the number of fish available at the beginning of the hatching season is not exactly known.

"The first fertilised eggs, about 5,000 in number, were placed in the hatching boxes on February 26th, and the last on May 9th. The ponds were skimmed on 32 days. The numbers of eggs were comparatively small throughout the season, exceeding 100,000 on 11 days only. The total number of fertilised eggs obtained was 2,949,000 and of larvæ set free 2,428,450. The cold and inclement weather of February and March, and the loss of spawners above alluded to were probably causes of the reduced numbers of eggs. It is possible, too, that reduced fecundity of the fish of the old stock may have contributed.

"The Hatchery Record, giving the number of eggs collected and of larvæ set free on the various days, is as follows:—

Eggs collected.	Date.	Larvae set free.	Date.
59,850	... Feb. 26 to March 3	53,650	... March 24
210,000	... March 5 to 15	118,650	... April 1
157,500	... ,, 17 to 24	140,700	... ,, 7
72,000	... ,, 26	65,700	... ,, 12
287,700	... ,, 31 and April 1	260,100	... ,, 17
226,800	... April 2 and 3	211,450	... ,, 21
535,500	... ,, 4 to 7	453,600	... ,, 24
312,900	... ,, 8 to 11	271,950	... ,, 30
268,800	... ,, 12 and 14	236,250	... May 2
415,800	... ,, 17 and 19	319,200	... ,, 5
273,000	... ,, 21 to 25	216,300	... ,, 8
129,150	... ,, 30 to May 9	80,800	... ,, 15
2,949,000	Total eggs.	2,428,350	Total larvae.

Lobster Culture.

"The supply of berried female lobsters with nearly ripe eggs during the past season was again disappointing, only fifteen being brought in, against 27 obtained during the corresponding period in 1918. These yielded a total of 9,702 larvæ, or an average number of 646 per lobster. This also compares unfavourably with the average of 1,223 yielded by the spawners last year. Of the total number of larvæ 9,050 were set free in the first stage, the number of rearing jars being still inadequate. The balance of 652 were placed in the rearing jars and fed exclusively on plankton. One hundred and seventy-two—or slightly more than 1 in 4—were successfully reared to the lobsterling stage and set free.

The Aquarium.

"The Aquarium has again shared the returning prosperity of the Isle of Man, 23,622 visitors having been admitted during the past year. Every effort was made to make the tanks as attractive as possible. The display of sea-anemones was larger and more varied than ever before, and attracted a large share of attention on the part of the more intelligent visitors. The third edition of the Guide to the Aquarium was exhausted before the end of the season, 1,666 copies having been sold.

(Signed) H. C. CHADWICK."

REPORT OF THE EDWARD FORBES EXHIBITIONER.

An "Edward Forbes Exhibition" was founded* in 1915, at the University of Liverpool, in commemoration of the pioneer marine biological work done in this district by the celebrated Manx naturalist, who was born about a hundred years ago. The object of the Exhibition is to enable some post-graduate student of the University to proceed to the Port Erin Biological Station for the purpose of carrying on some piece of biological research, more or less in continuation of the line of work opened up by Forbes, or an investigation which has grown out of such work.

The Edward Forbes Exhibitioner for the year 1919 is

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* The Regulations in regard to the Exhibition will be found at p. 77.

GEORGE FREDERICK SLEGGS, B.Sc., who spent a couple of weeks at Port Erin in April and again in July working at the structure, occurrence and habits of the living rock-barnacle *Balanus balanoides*. Mr. Sleggs has submitted to me a detailed report upon his work at Port Erin, but in view of the facts that (1) so far he has been engaged mainly on testing and verifying the results of previous observers, and that (2) the L.M.B.C. Memoir upon which he is now at work will, it is hoped, soon be ready for publication, it seems unnecessary to print anything further here.

L.M.B.C. MEMOIRS.

Since our last report was published, no further Memoirs have been issued to the public. HIMANTHALIA, by Miss L. G. Nash, M.Sc., is ready to print; Miss E. L. Gleave, M.Sc., has nearly completed her Memoir on DORIS, the Sea-lemon; Mr. Burfield, is writing the Memoir on SAGITTA; Mrs. Bisbee has made further progress with TUBULARIA, and still other Memoirs are in preparation.

The following shows a list of the Memoirs already published or arranged for:

I. ASCIDIA, W. A. Herdman, 60 pp., 5 Pls.
II. CARDIUM, J. Johnstone, 92 pp., 7 Pls.
III. ECHINUS, H. C. Chadwick, 36 pp., 5 Pls.
IV. CODIUM, R. J. H. Gibson and H. Auld, 3 Pls.
V. ALCYONIUM, S. J. Hickson, 30 pp., 3 Pls.
VI. LEPEOPHTHEIRUS AND LERNÆA, A. Scott, 5 Pls.
VII. LINEUS, R. C. Punnett, 40 pp., 4 Pls.
VIII. PLAICE, F. J. Cole and J. Johnstone, 11 Pls.
IX. CHONDRUS, O. V. Darbishire, 50 pp., 7 Pls.
X. PATELLA, J. R. A. Davis and H. J. Fleure, 4 Pls.
XI. ARENICOLA, J. H. Ashworth, 126 pp., 8 Pls.
XII. GAMMARUS, M. Cussans, 55 pp., 4 Pls.
XIII. ANURIDA, A. D. Imms, 107 pp., 8 Pls.
XIV. LIGIA, C. G. Hewitt, 45 pp., 4 Pls.
XV. ANTEDON, H. C. Chadwick, 55 pp., 7 Pls.
XVI. CANCER, J. Pearson, 217 pp., 13 Pls.
XVII. PECTEN, W. J. Dakin, 144 pp., 9 Pls.

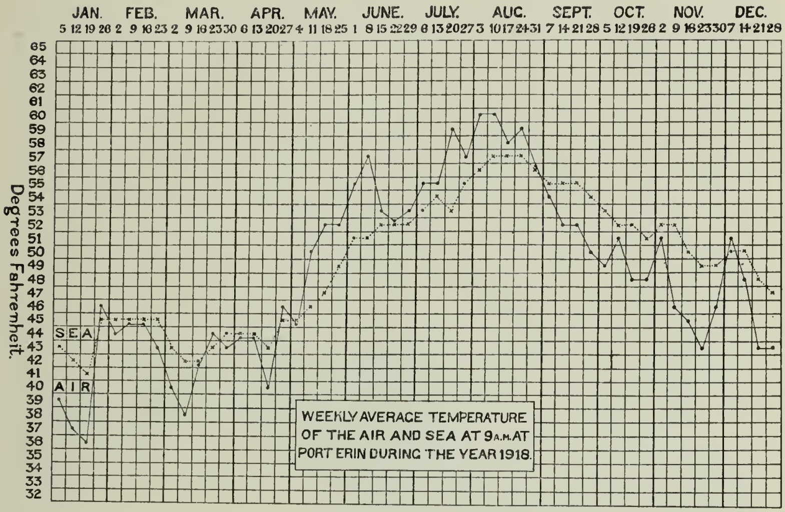
XVIII. Eledone, A. Isgrove, 113 pp., 10 Pls.
XIX. Polychaet Larvæ, F. H. Gravely, 87 pp., 4 Pls.
XX. Buccinum, W. J. Dakin, 123 pp., 8 Pls.
XXI. Eupagurus, H. G. Jackson, 88 pp., 6 Pls.
XXII. Echinoderm Larvæ, H. C. Chadwick, 40 pp., 9 Pls.
XXIII. Tubifex, G. C. Dixon, 100 pp., 7 Pls.
Himanthalia, L. G. Nash.
Doris, E. L. Gleave.
Tubularia, R. C. Bisbee.
Aplysia, N. B. Eales.
Terebella, C. P. M. Stafford.
Balanus, G. F. Sleggs.
Sagitta, S. T. Burfield.
Actinia, J. A. Clubb.
Zostera, R. Robbins.
Halichondria and Sycon, A. Dendy.
Oyster, W. A. Herdman and J. T. Jenkins.
Sabellaria, A. T. Watson.
Ostracod (Cythere), A. Scott.
Asterias, H. C. Chadwick.
Botrylloides, W. A. Herdman.

In addition to these, it is hoped that other Memoirs will be arranged for, on suitable types, such as *Pontobdella*, a Cestode and a Nematode.

As the result of a slight fire in the Zoology Department of the University, a portion of the stock of L.M.B.C. Memoirs has been partially destroyed. There are a certain number of damaged copies of some of the Memoirs which are stained or singed externally, but are still quite usable, and are suitable for laboratory work. The Committee has decided to offer these at prices ranging according to the condition from one-half to one-fourth of the published prices, as follows:—Memoir I., Ascidia, 6d. to 9d.; VI., Lepeophtheirus and Lernæa, 6d. to 1s.; VII., Lineus, 6d. to 1s.; XIII., Anurida, 1s. to 2s.; XIV., Ligia, 6d. to 1s.; XV., Antedon, 6d. to 1s. 3d.

Orders for these damaged copies should be sent to Professor Herdman, the University, Liverpool. New copies of any of the Memoirs should be ordered from the University Press, Liverpool.

The diagram of sea and air temperatures for 1919, compiled by Mr. Chadwick from his daily records, is not yet completed; but that for the preceding year, 1918, is inserted here as usual.



WEEKLY AVERAGE TEMPERATURE OF THE AIR AND SEA AT 9 A.M. AT PORT ERIN DURING THE YEAR 1918.

Appended to this Report are :—

(A) A short summary of the history and work of the Liverpool Marine Biology Committee.

(B) List of additions to the fauna and flora since 1896.

(C) The usual Statement as to the constitution of the L.M.B.C., and the Laboratory Regulations—with Memoranda for the use of students, and the Regulations in regard to the "Edward Forbes Exhibition" at the University of Liverpool;

(D) The Hon. Treasurer's Report, List of Subscribers, and Balance Sheet for the year.

IN FRONT OF THE BIOLOGICAL STATION, PORT ERIN, IN A STORM.

[*From a photograph by Mr. Edwin Thompson.*

APPENDIX A.

SUMMARY OF THE HISTORY AND WORK OF THE LIVERPOOL MARINE BIOLOGY COMMITTEE.

Drawn up by W. A. HERDMAN.

LIVERPOOL, 1885-1919.
PUFFIN ISLAND, 1887-1892.
PORT ERIN, 1892-1919.

The Liverpool Marine Biology Committee was founded at a public meeting held on March 14th, 1885, in the Zoological Laboratory of University College, Liverpool, and attended by representatives of the scientific societies and museums of Liverpool, Manchester and Chester, and by other local naturalists. It was unanimously resolved that a committee be formed to investigate the Marine Biology of Liverpool Bay and the adjoining parts of the Irish Sea, a programme of work was adopted and officers were appointed. In addition to several shipowners and leading merchants of Liverpool who supported the enterprise, the Committee consisted of the following scientific men :—

Frank Archer, B.A. (Conchologist), Liverpool.
R. D. Darbishire, F.G.S. (Conchologist), Manchester.
Professor Harvey-Gibson, M.A., Liverpool.
Professor Herdman, D.Sc., Liverpool.
Rev. H. H. Higgins, M.A., Public Museum, Liverpool.
Professor Milnes-Marshall, F.R.S., Manchester.
T. J. Moore, Curator, Public Museum, Liverpool.
Isaac Roberts, F.G.S., Liverpool.
Isaac C. Thompson, F.L.S., Liverpool.
A. O. Walker, F.L.S., Chester.

Amongst others who have joined the Committee during the past 34 years are Dr. W. Evans Hoyle, then at Manchester, Professor Benjamin Moore, then at Liverpool, and Arnold T. Watson, F.L.S., of Sheffield.

The Committee commenced its work by dredging and trawling expeditions in Liverpool Bay from tug-boats and other small steamers, and by examining exhaustively the shore fauna at Hilbre Island and other points in the estuaries of the Mersey and Dee at low tides.

As the result of the first year's work the Committee published an 8vo. volume of 370 pages, illustrated with plates and maps, and entitled "The First Report upon the Fauna of Liverpool Bay and the neighbouring Seas." This volume placed on record nearly 1,000 species, which was increased to nearly 1,850 by the time of the Report to the British Association, published in 1896, and has since reached approximately 2,500.

Hilbre Island is certainly one of the most interesting spots in the immediate neighbourhood of Liverpool, from a biological point of view, and has long been well known to the local naturalists on account of its comparatively rich marine fauna. The rocks at the northern end of the island are covered at and about low water mark by a large and varied assemblage of invertebrate animals, and form a particularly favourable locality for certain Hydroid Zoophytes, Actiniæ, Polyzoa, and Nudibranchs.

The interesting reef-building gregarious Annelid, *Sabellaria alveolata*, is found in abundance round some parts of the shore at Hilbre Island, usually near where sand and rock adjoin. It sticks the sand grains together to form the tubes in which it lives, and so produces masses of a porous, crisp, but brittle material, which crumbles to a certain extent when walked upon, but which is constantly being renewed and has its injuries repaired by the living worms within, and must, therefore, have a very considerable effect in protecting the rocks from the erosive action to which our sea coasts are exposed.

During the second year's work it became obvious to the Committee that in order to advance further in their explorations and to carry on detailed investigations into the habits and life-histories of the marine animals of the neighbourhood, it would be necessary to establish a small seaside laboratory or biological station at some suitable spot in the district. This idea led, after the consideration of various localities, to the conversion of the old Dock Board observatory and signalling station on the seaward end of Puffin Island, at the northern entrance to the Menai Straits, into a biological station which was opened for work in the summer of 1887 and remained in constant use as the marine laboratory of the Committee until 1892.

The first of our series of 33 Annual Reports gives an account of the natural features of Puffin Island, of the accommodation at the converted observatory, and of the manner in which the Liverpool naturalists and their working party during some days in May, encamped on the Island with their materials and goods; and cleared out, repaired and fitted up the new institution so as to render it habitable. Much work was carried on during the remainder of that summer and autumn by various members of the Committee and other visiting naturalists, and the following sentences may be quoted from the First Annual Report to give some idea of the conditions of work on that lonely island :—

" Shore collecting on Puffin Island on a summer morning, with a low ebb tide, is most delightful work. The naturalist explores the deep crevices and pools in the limestone reefs, lifts up or turns over the smaller of the detached fragments of rock and creeps under the larger ones, peering curiously into all the corners and crannies, and probably oblivious of the pool in which he has placed his knees and of the stream of drops which is trickling down the back of his neck. He sees covering the lower surface of the stones and festooning the rock delicate sprays of beautifully shaped Zoophytes, elaborately sculptured Polyzoa, and masses of incrusting Sponges with gorgeous colouring. He sees strange looking masses of Ascidians, which if incautiously touched suddenly emit two tiny jets of water, thus vindicating their claim to the title of 'sea-squirts.' These and various other marine animals—especially the sea-anemones and the Nudibranchs—almost defy description; they must be seen to be appreciated."

Besides the collecting and identifying of specimens, work on which all the Committee were engaged more or less, various pieces of more detailed research were commenced, and these along with the faunistic results have been reported upon in the various papers and memoirs published in successive years. Mr. Joseph Lomas in this way took up the group of Polyzoa, Dr. Hanitsch started investigations on the Sponges, and Mr. Isaac Thompson from this time onwards till his death in 1903 made notable investigations on the Copepoda, while Mr. Alfred Walker reported on the Higher Crustacea from Amphipoda onwards.

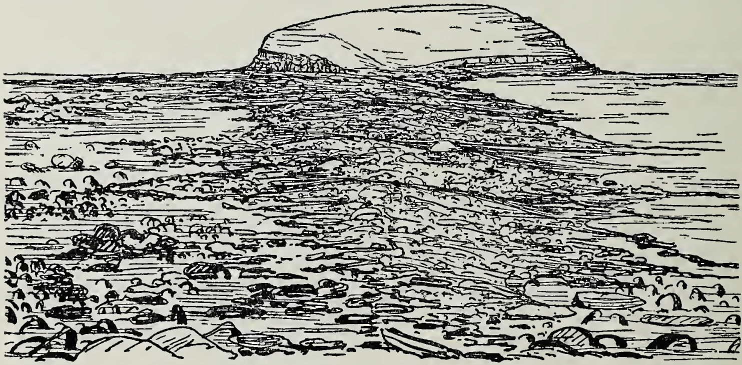


FIG. 1. Puffin Island from the South Spit at low tide.

The two functions which the Liverpool Marine Biology Committee endeavoured to fulfil by means of the Puffin Island

Biological Station were, first, to afford opportunity to the younger biologists and students of the neighbourhood of becoming acquainted with marine animals and plants, alive, and in their natural conditions, and of learning how to investigate a fauna and how to conduct marine research in general; and, secondly, to procure supplies of material of the various groups of animals required by the specialists who were engaged in working up the fauna and flora of Liverpool Bay. During the early years most attention was directed towards the second of these functions, and all the earlier reports of the Committee will be found to record additions to the known lists in most groups of animals. Of late years, however, since about 1896, the Committee and their Curator at the later Port Erin Biological Station have paid more attention to promoting the higher education of University students and research which is not purely faunistic.

A prominent feature of the work of the Committee in these early years was the series of dredging expeditions lasting for several days at a time in the "Hyæna" or other steamer lent for the purpose by the Liverpool Salvage Association. In May, 1888, for example, a three days' cruise was undertaken to the Isle of Man, the first day being spent between Liverpool and Ramsey, the second in working along the coast of the Isle of Man between Ramsey and Port Erin, and the third in returning to Liverpool. On this occasion the Committee made some acquaintance with the rich fauna around the south end of the Isle of Man, and this may be regarded as the first step towards the migration from Puffin Island to Port Erin, which was effected four years later. It was on this occasion, while anchored at night in Ramsey Bay, and again the following night in Port Erin Bay, that the Committee successfully used bottom and surface tow-nets containing submarine electric lamps, and captured by this means much larger numbers of certain free-swimming Crustacea than were obtained from the control nets without illumination. The Crustacea captured in the net with the electric light were mainly Amphipoda, such as *Ampelisca lævigata* and *Dexamine vedlomensis*, and certain Cumacea (*Cuma scorpioides*, *Iphinoë trispinosa* and *Pseudocuma cercaria*), which are rarely met with in quantity. Mr. Walker pointed out in his report that all the Cumacea taken both at Ramsey Bay and Port Erin were males, and that the probable reason is that the males of all the three species represented are provided with pleopoda (or swimmimg legs), while the females are not, and that consequently the males are no doubt more active swimmers, and, therefore, more likely to rise from the sea-bottom where they live. In the illuminated surface nets the remarkable feature was the quantity of Copepoda, which were identified and reported upon by Mr. Isaac Thompson. Apart from the considerable number of species added to our faunistic results by this expedition, the "Hyæna" cruise of May, 1888, is note-worthy on account of the successful application of the electric light as an attraction in both surface and bottom nets worked after dark.

This matter was carried further in a five days' cruise round the Isle of Man at Easter, 1889, when a considerable number of rare and interesting Crustacea (chiefly Schizopoda, Cumacea and Amphipoda) were captured. The large number of Cumacea, and especially adult males of *Iphinoë trispinosa* was a marked feature, not merely in the bottom nets, but also at the surface, in an area which had been illuminated by the electric light for half an hour before the nets were put over. In none of the daylight tow-nettings, either bottom or surface, was a single Cumacean obtained, while every gathering on the two nights when we had the electric light in operation contained Cumacea in abundance. Full details of the matter are given in our third Annual Report. That free-swimming Crustaceans are attracted to a stationary net by the electric light may now, after our experiments of 1888 and on this last cruise, be considered established beyond doubt; and that the illuminated tow-net can be used in at least moderately deep water was evident to all who saw the success with which the net was worked on board the "Hyæna" in thirty fathoms.

In this year (1889) the second volume of the "Fauna" appeared containing reports on various groups, from Diatoms up to Seals and Cetaceans, including the description of several Invertebrata new to science.

In this year, also, we continued the observations on the "zoning of the shore"—that is, the distribution of characteristic animals and plants in relation to high and low water levels and depths below low water mark—which we had started at Hilbre Island in 1885 and at Puffin Island in 1887, and which leads to some curious results such as that the Polyzoon *Flustrella hispida*, found within a yard of average high water, is exposed to air during about five-sixths of its existence and can only feed and expand during the remaining one-sixth at and about the time of high tide; and that the common rock barnacle, *Balanus balanoides*, is able to live so far above ordinary high water mark as to remain dry for days at a time amounting to eighteen or nineteen-twentieths of its life. Observations were also made on certain other marine animals which can live above high water mark, such as the Copepod *Harpacticus fulvus* and the Gastropod Mollusc *Littorina rudis*.

Other notable features of the work during 1889 were (1) the experiments with Mr. Hoyle's deep-sea closing tow-net designed to capture the plankton in certain limited zones of water intermediate between the bottom and the surface; (2) observations on the structure and function of the highly-coloured processes or cerata projecting from the body of Nudibranchs such as *Dendronotus*, *Tritonia*, *Doto* and *Eolis*, and their usefulness as protecting or warning characters—this matter was continued on future occasions and the results were fully discussed in a later report*; (3) the faunistic results of various dredging expeditions leading to the addition of some species new to science or to the British seas.

One of the most interesting finds in the following year (1890) was the phosphorescent Schizopod *Nyctiphanes norvegica* obtained in quantity by tow-netting off Puffin Island on an early winter morning before it was light. This organism is found in abundance near the bottom in the deep fjord-like lochs on the west coast of Scotland, and we have since obtained it from deep water in the channel between Ireland and the Isle of Man; and as it has been supposed to be one of those northern forms which have been left behind in a few deep holes as relics of a former fauna (the boreal outliers of Edward Forbes), it is of special interest to find that it comes to the surface at night.

During this year (1890) Professor Harvey-Gibson, along with Mr. George Murray, Mr. E. A. Batters and other visiting botanists, collected and identified the Algæ of Puffin Island and put on record 275 species, including a number of rare forms and at least 27 new to the district (see 4th Annual Report where further details are given).

In this same year Mr. Hornell was working on Polychæt worms, Dr. Hanitsch on Sponges, Mr. Clubb on the Nudibranchiata, Mr. F. G. Pearcey on Foraminifera, and Mr. Thompson continued to add new records of Copepoda to our list, including some unusual forms from tow-nettings taken at night or from nets attached to a buoy and left swinging with the tide for 24 hours. As usual, we had several expeditions in the "Hyæna" or other steamers during the Easter or Whitsuntide holidays, which always added largely to the supply of material for distribution to our specialists.

The following year, 1891, was our last at Puffin Island, as the Committee had now decided to establish a more important laboratory at Port Erin near the south end of the Isle of Man in order that they might have the opportunity of investigating the rich marine fauna of that neighbourhood. The Fifth Annual Report contains many records of additions to most of the groups of marine Invertebrata, and some observations on the distribution and habits of shore animals. The following paragraphs may be quoted as an example of some of our experiences during the days that many of the Committee spent from time to time on Puffin Island :—

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* See Herdman and Clubb, *Quart. Journ. Micr. Sci.*, Vol. XXXIII, p. 541, (1892); also Third Report upon the Nudibranchiata, in 'Fauna,' Vol. III.

"During the remainder of our stay the weather was perfect. In fact, on the second day it was so calm that in the evening at low tide we were able to row into the wonderful 'sponge caves' on the north side (which can only be entered at the lowest of tides and on a calm day, and then only in a small boat), for the purpose of inspecting their treasures. The two large caves are close together, and have been hollowed by the sea out of the bases of the high limestone cliffs. Their mouths face seawards towards the Irish coast, and on entering the boat has to be pushed (it is too narrow to row) through a long tunnel-like passage, with vertical walls, to the inner end, with its small piece of sloping gravel beach, where one can land—in the dark. On striking a match it is seen that the sides of the cave are closely encrusted with various kinds of colonial and sessile animals, especially with sponges, the characteristic feature of the place. Here one revels in *Pachymatisma johnstoni*, *Dercitus bucklandi*, *Plumohalichondria atrosanguinea*, and other many-hued slimy-looking Tetractinellids and Monactinellids. Here we first found, a few years ago, the rare new genus which has been named 'Seiriola,' in honour of our sainted predecessor on the isle (probably a good biologist according to the lights of his day and generation), who lived, as the naturalist always loves to do, beside the sea, the rocks, and the Puffins, and who possibly shoved his coracle on a calm evening into the sponge caves and saw in the dim light those curious white masses on the rock which some thirteen centuries after were dedicated to his memory. . . . .

"We collected altogether on this occasion thirteen species of Nudibranchs, including the rare *Eolis landsburgi;* also a very remarkable sponge belonging to the genus *Suberites*, and another sponge of a dark orange colour—one of the Desmacidonidæ—which was found by Dr. Hanitsch in one of the caves. This will probably turn out to be an interesting novelty as the sponge is in symbiosis with a Zoophyte. The hydrorhiza of the Zoophyte permeates the sponge in all directions and replaces to a certain extent the missing spongin fibres. The spicules of the sponge are found echinating the hydrorhiza of the Zoophyte."

This brings us to the time of the formation of the Lancashire Sea-Fisheries Committee, with which, from the first, we established friendly, and immediately afterwards, official connections. Mr. R. A. Dawson, the Fisheries Superintendent of the district, took part in some of our expeditions and gradually enlisted our services in Sea-Fisheries work, which led to considerable results in the future.

The Sixth Annual Report, for the year 1892, started a new record as the first of the series of nearly thirty reports dealing with the Biological Station at Port Erin. The Puffin Island establishment had been very useful to the Committee, and was well worth the small annual expenditure required for its modest outfit. It had been used by some students of the local Colleges who wished to gain a general knowledge of the common marine animals and plants in a living state, and by a considerable number of specialists who went there to make observations, or who had the material for their investigations collected there and sent to them.

It had been felt, however, by the Committee for some time that a station which was more readily accessible from

Liverpool, and with hotel or lodging accommodation on the spot, would enable their specialists to do more work, and be of more use to students and investigators generally. Also it was becoming evident that after five years work on the shores of the small island the greater number of the plants and animals had been collected and examined, and that a change to a new locality with a rich fauna and a more extended and varied line of coast would yield increased material for faunistic work.

After considering many possible localities on the shores of the Irish Sea, the Committee unanimously decided that no other spot seemed to be so suitable and to offer such advantages for their work as Port Erin at the south end of the Isle of Man. As a result of several visits and negotiations with local authorities, a simple building*, containing a couple of small laboratories and some aquarium tanks only, was erected on the shore close to high-water mark on the north side of the Bay, and a formal opening by the Lieutenant-Governor of the Island (Sir Spencer Walpole), in the presence of a large number of marine biologists and others interested, took place on June 4th, 1892. A full account of the inauguration will be found in the Report for that year. And so we moved from Puffin Island, Anglesey, to Port Erin, Isle of Man—as was said at the time, from "the Mona of Tacitus to the Mona of Caesar"—a step that has proved advantageous in every respect.

The Port Erin Station occupies a fairly central position in the Irish Sea, being about 30 miles from Ireland, 33 miles from Scotland, 40 miles from Wales and about 45 miles from the nearest point of England. The Bay faces nearly West and is in most winds a good natural harbour with sand at the inner end and bounded by precipitous cliffs beyond to the North and South. From its position and the shape of the land Port Erin has, within a distance of a couple of miles in three directions,

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* Replaced in 1902 by the present much larger institution on the opposite side of the Bay.

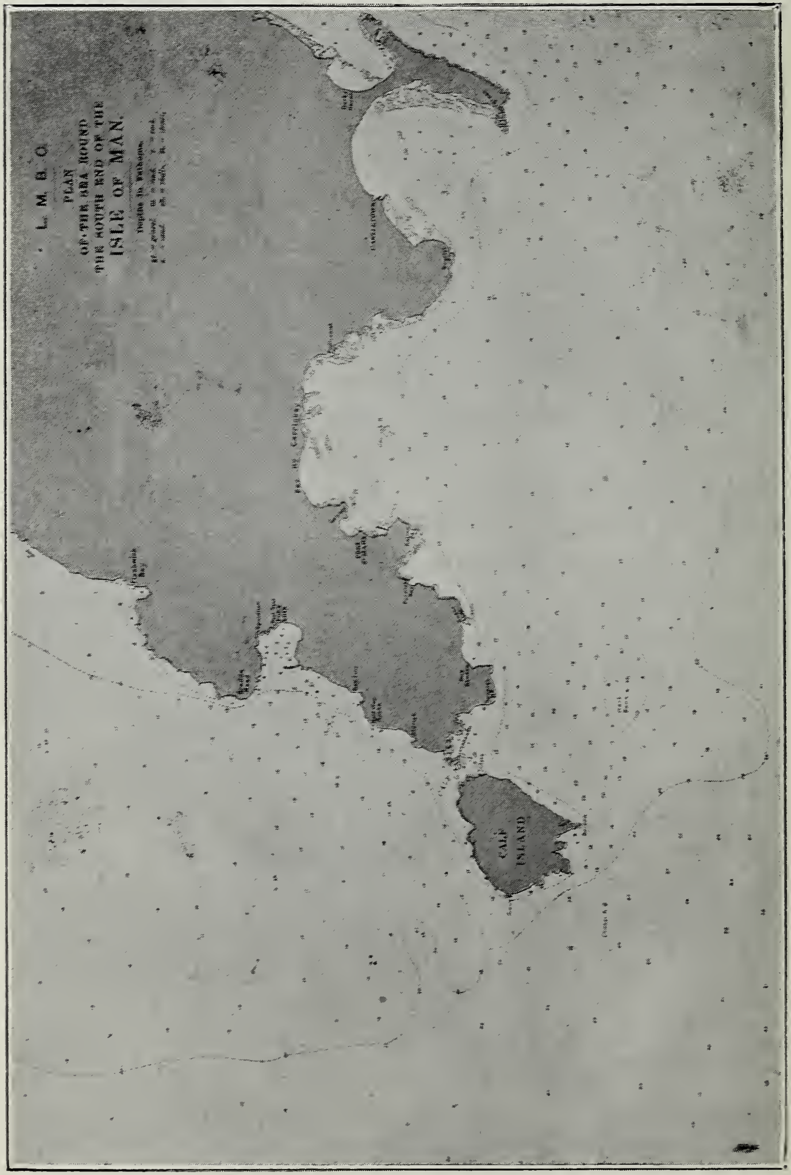

Fig. 2. The sea and coast-line round the south end of the Isle of Man.

to Fleshwick Bay, to the Calf Sound and to Port St. Mary, a long and varied coast-line with a number of small bays furnishing good collecting grounds and shallow water dredging. Two of these bays, Port Erin and Port St. Mary, have harbours with sailing-boats and face in nearly opposite directions, so that in most winds one or other is sheltered and has a quiet

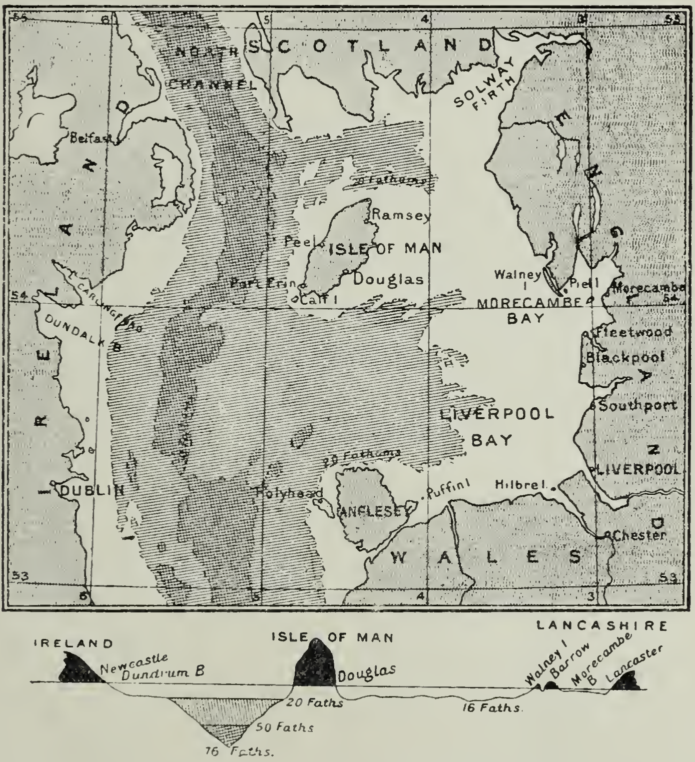

Fig. 3. Plan of the L.M.B.C. District, with section across the Irish Sea, through Douglas.

sea for inshore work. The rich fauna around the Calf Island and off Spanish Head is within easy reach, while at a distance of three to four miles from the Biological Station are depths of 20 to 30 fathoms and at 14 miles, 60 to 80 fathoms (figs. 2 and 3).

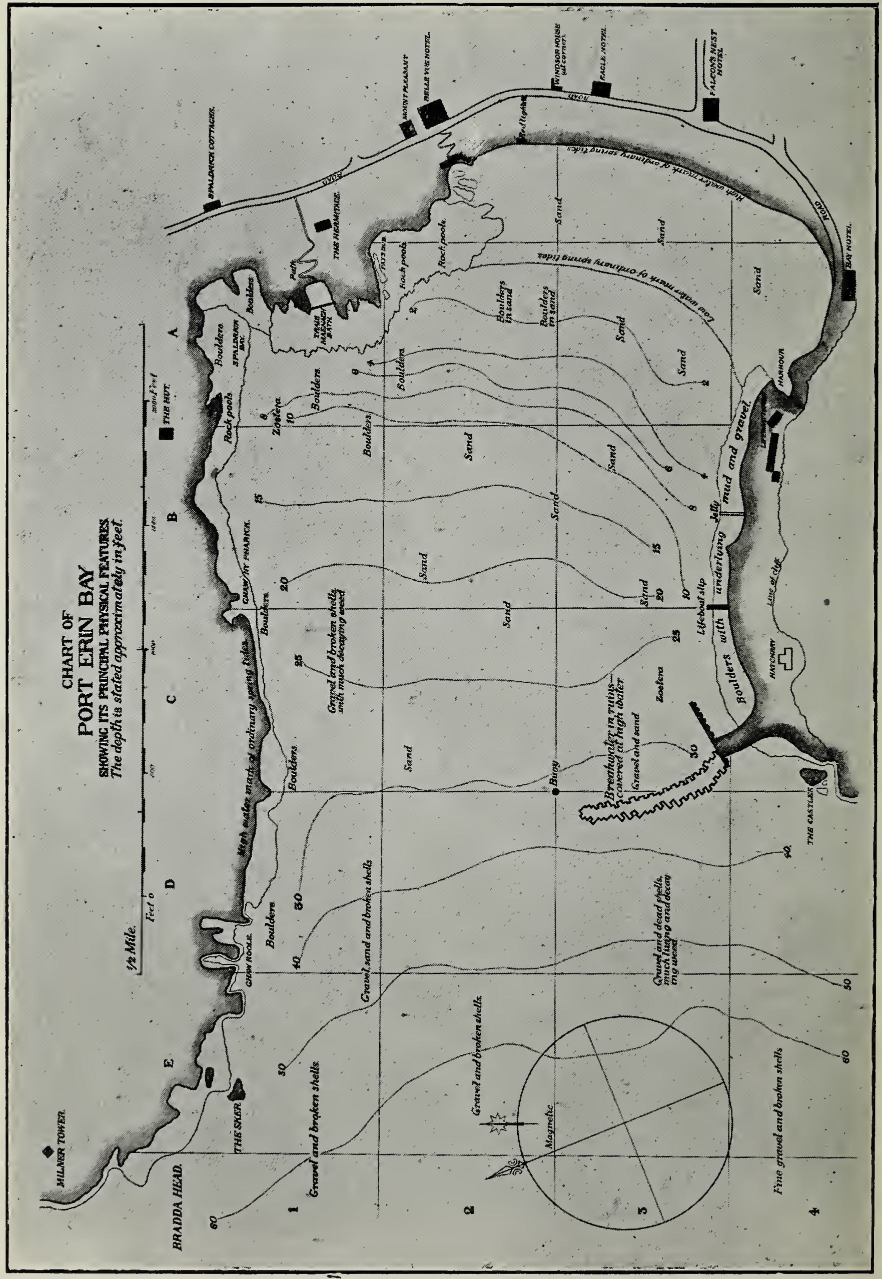
CHART OF
PORT ERIN BAY
SHOWING ITS PRINCIPAL PHYSICAL FEATURES.
The depth is stated approximately in feet.
½ Mile.
Feet 0
1000 Feet
A
B
C
D
E
1
2
3
4
MILNER TOWER.
BRADDA HEAD.
THE SKER
Boulders
High water mark of ordinary spring tides
GHAW 'NY PHARICK
Rock pools
THE HUT
SPALDRICK BAY
TRAIE MEANAGH BATH
Path
THE HERMITAGE
SPALDRICK COTTAGES
ROAD
MOUNT PLEASANT
BELLE VUE HOTEL
WINDSOR HOUSE
EAGLE HOTEL
FALCON'S NEST HOTEL
BAY HOTEL
Low water mark of ordinary spring tides
Boulders in sand
Zostera
Sand
HARBOUR
Jetty
Lifeboat slip
Boulders with underlying mud and gravel
HATCHERY
Line of cliff
Breakwater in ruins—covered at high water
Gravel and sand
Buoy
THE CASTLES
Gravel and broken shells with much decaying weed
Gravel, sand and broken shells
Gravel and broken shells
Gravel and dead shells, much fungi and decaying weed
Fine gravel and broken shells
Magnetic
2
4
6
8
10
15
20
25
30
40
50
60

FIG. 4.

The plan of Port Erin Bay (Fig. 4) shows the position and surroundings of both this first and also of the present larger Biological Station, and gives some idea of the depths and nature of the collecting grounds inside the Bay.

On the occasion of the opening of the Station the Liverpool Salvage Association lent their steamer "Mallard" for several days dredging and tow-netting around the south end of the Island, when large collections were made at depths down to 60 fathoms.

The opening of the Biological Station at Port Erin at once led to greatly increased numbers of workers, and during the summer of 1892, in addition to members of the Committee and Liverpool students, marine biologists from Manchester, Sheffield, Cambridge, Aberystwyth, London and Edinburgh spent some time in the laboratory. Mr. W. J. Beaumont from Cambridge made some interesting observations on the polypes of the rare Alcyonarian *Sarcodictyon*, and Mr. E. T. Browne from London started those investigations on the Medusoids of Hydroid Zoophytes upon which he has written many papers since.

Amongst other interesting animals found during that summer in the immediate neighbourhood of Port Erin were the Foraminifera, *Astrorhiza limicola* and *Haliphysema tumanowiczii*, the tubicolous Infusorian *Folliculina ampulla*, the Turbellarian *Convoluta*, the remarkable worms *Dinophilus tæniatus* and *Spadella*, and quite a number of Nudibranchs and Compound Ascidians. Mr. Walker continued to add new records of Amphipoda and Mr. Thompson of Copepoda, one of the latter being *Notopterophorus papilio*, an interesting addition to our fauna.

At the meeting of the British Association held that summer in Edinburgh some of our more active workers were constituted a Research Committee of the Association with a grant to be expended in exploring further the southern part of the Irish

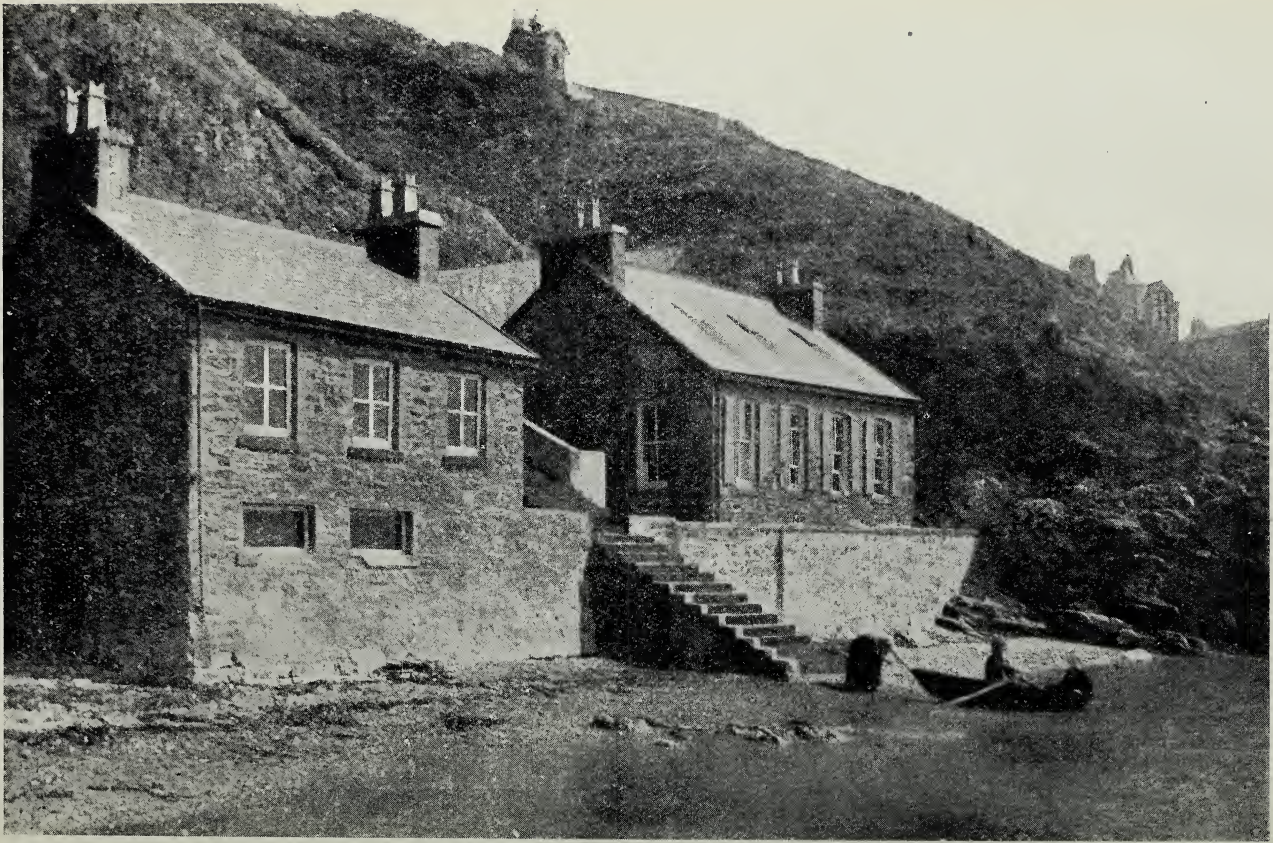

Fig. 5. The original Biological Station at Port Erin.

Sea. This British Association Committee continued its work for four years, furnished reports to successive meetings of the Association and in its final report, to be found in the volume for 1896, gave a complete list of all species recorded up to that date as the result of our explorations.

The third volume of the Fauna was published in July, 1892, and contained papers on the Marine Algæ, Sponges, Worms, Crustaceans, Mollusca and Ascidians.

Finally, in this Sixth Report (1892) a record is given of some observations on the remarkable variations in colour of the small shore prawn *Virbius* (or *Hippolyte*) *varians*, illustrated by a coloured plate showing a brown *Virbius* simulating the elongated segmented brown floats of the brown sea-weed *Halidrys siliquosa*, a red and white banded *Virbius* found inhabiting masses of the red sea-weeds *Delesseria* and *Rhodymenia*, and a bright green *Virbius* lying lengthways along the blades of the green sea-grass *Zostera marina*, and bearing eggs which are also green, while specimens found on a sandy bottom or on small gravel are mottled black, grey and white, so as to be very effectively protected by their colouration. This matter was investigated in much more detail some years later by Professor Gamble.

In the following Report, for 1893, we find a list of over 60 workers who made use of the Station for collecting or investigation, including Professor Brady and Professor Potter from Newcastle, Captain Dannevig from Norway, Professor G. B. Howes from London, and others.

Captain Dannevig's visit was at the request of the Lancashire Sea-Fisheries Committee, in order that he might give evidence before them as to the suitability of the locality for a Fish-Hatching establishment. He reported both to that Committee and also to the Select Committee of the House of Commons on June 15th that he regarded Port Erin as the most suitable place in the neighbourhood for the establishment of such an institution for fish culture. It may be added here that legal and administrative difficulties were found to be an insuperable bar, and the Lancashire Committee had to find another locality, namely, Piel Island in the Barrow Channel, within their own administrative district; but some years later the Manx Government took up the same matter, and in co-operation with the Liverpool Marine Biology Committee erected the new Biological Station and Fish Hatchery at the opposite side of Port Erin Bay. A connection was, however, at this time established between our Port Erin Station and the Lancashire Sea-Fisheries Committee, which has been continued through the intervening years, has led to a good deal of co-operation, and will be still closer in the future now that the scientific work of both is united in the Department of Oceanography at the University of Liverpool.

On several occasions in 1893 we had the use of the Lancashire Sea-Fisheries steamer "John Fell" for taking observations in the deeper waters around the Isle of Man, and especially in the deep channel lying between Port Erin and Ireland, where we worked down to a depth of 79 fathoms in the interesting assemblage of mud-inhabiting animals, including *Bougainvillia muscus*, *Adamsia palliata*, *Sagartia herdmani* (on *Turritella* shells), *Porania pulvillus*, *Palmipes membranaceus*, *Amphiura chiajii*, *Brissopsis lyrifera*, *Lumbriconereis* sp., *Panthalis oerstedi*, *Lipobranchius jeffreysii*, *Hyalinœcia tubicola*, *Alcyonidium gelatinosum*, *Scalpellum vulgare* (on *Antennularia*), *Calocaris macandreæ* with its associated Polyzoon *Triticella boeckii*, *Rissoa abyssicola*, *Nucula sulcata* and *Isocardia cor.*

A further account of work on this ground and of the nature of the bottom deposits in various parts of our area will be found in the report for the following year, which includes also a record of Mr. Arnold Watson's interesting observations on the method of tube-building by *Panthalis oerstedi*. From this time onwards Mr. Watson took up this subject, the method of building sandy and muddy tubes by various common Polychæt worms as his specialty, and made a number of interesting observations which were communicated in successive years to meetings of the British Association, and were from time to time recorded in our Reports. He was wonderfully successful in keeping dredged Annelids alive for long periods so as to be able to study their habits. Even the deep-water *Panthalis*, dredged from 70 fathoms, was induced by him to live in a few inches of water in a small aquarium at the Biological Station, where it deserted its old tube and proceeded to form a new one in the mud against the glass side of the aquarium so as to expose all its operations to Mr. Watson's careful observation.

A considerable number of other additions to the fauna, chiefly of microscopic forms such as the Copepoda, will be found in each of these Annual Reports about this period when dredging expeditions were so frequent.

Our British Association Committee, which continued its work, was now requested by Sir Archibald Geikie (then Director-General of the Geological Survey) to form a series of samples of the various deposits brought up by the dredge from various parts of the Irish Sea for examination and preservation in the Museum of the Geological Survey at Jermyn Street. For several years after this, samples of the deposits were packed in small canvas bags and sent to the Museum. These have been reported on by Professor Watts, the late Mr. Clement Reid and others (see especially the Seventh Annual Report, pp. 30-32, and the Eighth Report, p. 35).

Amongst other observations of bionomic interest which were made at this time I may mention the swarms of the common shore Amphipod *Orchestia gammarellus* which on several occasions migrated upwards from the shore far above high-water mark, invaded the Biological Station in countless numbers so as to cover the floor, tables, shelves, windowledges and even dishes placed high on the walls, in great profusion. They were seen to be jumping up the steps leading from the beach and to be able to climb the vertical concrete wall of the Station to a height of several feet. These invasions seem to be on occasions of exceptionally high tides coinciding with a heavy shower of rain.

In the Report for the following year, 1894, we see the beginnings of the connection which was afterwards established between the Liverpool Committee and the Isle of Man Government for the promotion of fish culture at Port Erin. An Act of Tynwald was passed creating a Fishery Board for the Island with powers to make bye-laws and promote the local fishing industries in other ways. This movement led to the introduction of fisheries work at the Biological Station. Observations on the spawning seasons and localities and experiments in the hatching of the fertilised ova of various food-fishes were carried on during this and following years.

It may be of interest to insert here the following account of the procedure adopted on one of the dredging expeditions in this year. It is a good example of the advantages of "team-work" in such an investigation.

"When the first locality is reached the spot is determined on the chart, and the depth verified by a cast of the lead. Then the dredge (measuring 2 feet 6 inches by 1 foot, and weighing from 30 to 40 lbs.) is sent down with a tow-net tied on the rope about two fathoms from the dredge. Very often a smaller dredge with a bag of cheese-cloth is sent over on the other side of the ship. One or more surface tow-nets are also put out. The tow-nets, both surface and deep, are looked after by Mr. I. C. Thompson, who first turns out their contents into a clear glass jar of sea-water, and then, after noting the general character of the catch and any specially conspicuous forms, strains off the water through a small bag made of very fine millers' silk, and transfers the 'plankton' left adhering to the

The Honorary Treasurer of the Liverpool Marine Biology Committee ventures to express the hope that the subscribers who have so kindly supported that Committee in the past, and enabled them to carry on their work of exploration and investigation, will be willing to continue this financial support in the future, as it is essential to the proper maintenance and further development of the Port Erin Laboratory. The endowment of the Chair of Oceanography ensures that a competent University professor will be provided to direct the Laboratory, but the other expenses of the Institution will require to be met in the future as in the past. Subscriptions from 1st January, 1920, should be sent to the Accountant of the University of Liverpool.

W. A. HERDMAN
(*Honorary Professor of Oceanography*).

EDWIN THOMPSON
(*Honorary Treasurer of the Liverpool Marine Biology Committee*).

University of Liverpool,
December 18*th*, 1919.

To the Subscribers and Correspondents of the Liverpool Marine Biology Committee.

In sending you the enclosed 33rd Annual Report of the Liverpool Marine Biology Committee we desire to point out that although it is the last Report to be issued by that Committee, the work both at the Port Erin Biological Station and also elsewhere in the Liverpool Marine District does not cease, but will be carried on in future by the Staff of the Oceanography Department of the University of Liverpool—as will be found explained in the Report.*

The Honorary Director (in future the Professor of Oceanography) wishes to state for the information of researchers, students and others desiring to visit the Port Erin Laboratory that that Institution will be carried on in the future, so far as can be foreseen, on the same lines as in the past. The L.M.B.C. Memoirs and other publications from the Port Erin Laboratory and the Oceanography Department will in future be issued by the University Press. From 1st October, 1920, the Professor of Oceanography and Director of the Biological Station will be Dr. James Johnstone.

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* See pp. 3 and 4, and the Treasurer's Report at p. 79.

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silk to a tube containing his special preservative fluid formed of spirit, glycerine and water in certain proportions.

" When the dredge is brought up it is emptied on deck, and after a note of the general character of the deposit and assemblage of animals has been taken, any specially large or rare specimens are picked out and transferred to buckets or jars of sea-water, or to store-bottles of spirit. Then the heap is spread out so as to form a layer not more than one or two inches in depth, and one or two members of the Committee (Herdman and another, Walker or Leicester) now settle down beside it to pass the entire mass in review inch by inch, working it across a small space of bare deck and turning over every shell, stone and specimen with an iron spoon, so as to ensure that nothing escapes observation and due record in the note-book. In the meantime the contents of the bottom tow-net have been dealt with by Mr. Thompson, and the apparatus has been lowered for a second haul, or the vessel is steaming on to a new locality. Then a fair sample of the deposit is selected for preservation (for the Geological Survey) in a small canvas bag (10 by 5 inches), care being taken to include some of the characteristic bottom animals—shells, ophiuroids, polyzoa, etc.

After this sample has been removed, and special animals required have been picked out and put into store-bottles, the whole of the remainder of the haul is passed gradually through our set of three sieves (meshes $\frac{3}{4}$ inch, $\frac{1}{4}$ inch, and $\frac{1}{8}$ inch respectively), which work up and down in a tall iron cylinder filled with sea-water. The sieves are disconnected and examined at intervals, and in this way many of the smaller animals of all groups are detected and picked out. Finally, the water in which the sieves have been plunging is strained by Mr. Thompson through his fine silk net, and in this way many of the rarer bottom Copepoda are obtained, while the finer sandy and muddy deposits retained by the finest sieve or in the bottom of the cylinder are packed in canvas bags by Mr.

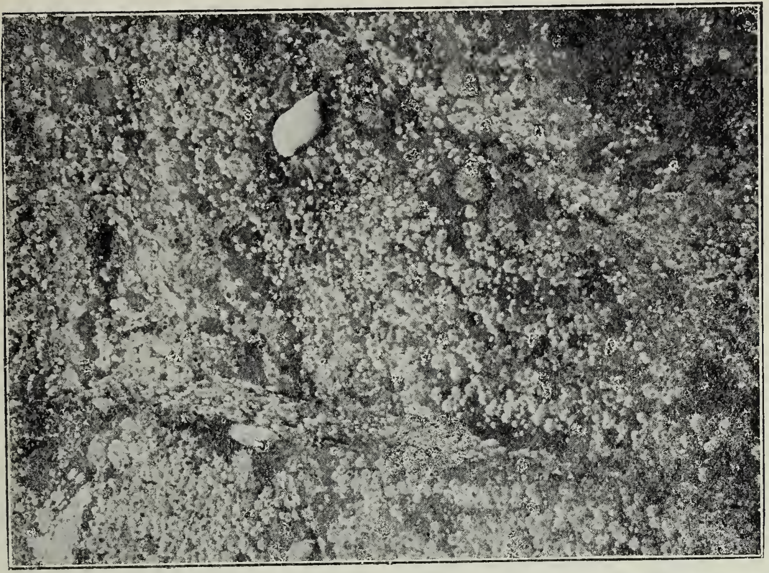
Alfred Leicester for further examination at home. These contain, of course, many minute Mollusca, Ostracoda and Foraminifera. By the time these various processes have been completed the dredge has usually been hauled again, and a fresh heap is lying on the deck awaiting investigation. On a successful trip the members of the party, on an average four to six in number, are kept constantly occupied, each man at his own work, from the commencement of the first haul till the steamer is turned homewards, and after that the packing and labelling of specimens fill up the time until land is reached."

This year Professor G. S. Brady reported on our gatherings of Ostracoda and furnished us with a considerable list which is printed in the Report, including several rare forms and one new to Britain.

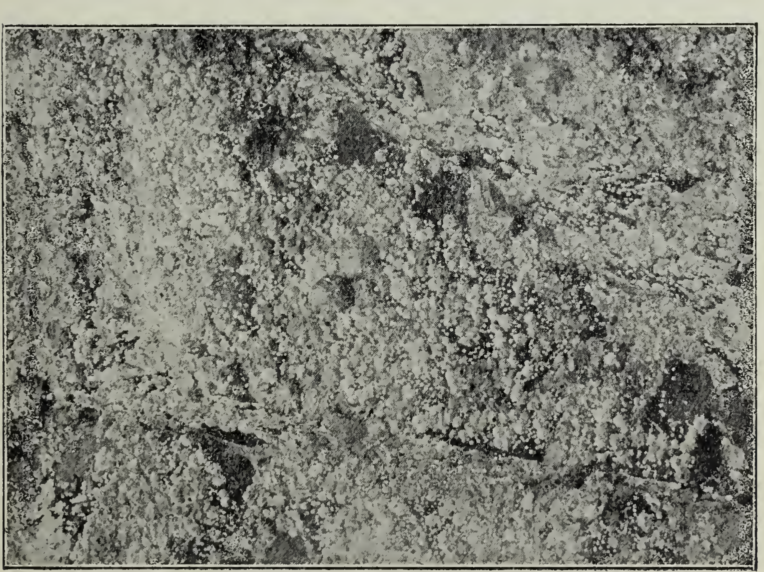
The work of the Rev. T. S. Lea in photographing characteristic specimens of the marine algæ *in situ* at low-tide commenced about this date and was continued for some years. Mr. Lea also photographed the rocks and stones of some of our best collecting-grounds and some of the assemblages of animals brought up on our dredging expeditions (Figs. 6, 7 and 8 show some examples of Mr. Lea's work).

In this year also we started the investigation of the movements of swarms of Copepoda, Medusae and other more abundant members of the plankton, and endeavoured to ascertain the result of the prevalent currents, tidal or otherwise, by distributing large numbers of "drift-bottles" containing numbered notices to be filled in with locality and date and be returned by the finder. This method of setting free drift-bottles and keeping records of their travels was continued for some years, and has also been practised by the Fishery Board for Scotland, the U.S. Coast Survey, the Prince of Monaco and others.

Volume IV of the Fauna was issued early in 1895, and this brings the reports on the work of the Committee up to the



June, 1897.



June, 1898.

FIG. 6. Vertical rock-face, Port Erin, six feet above low-water.
[*From photographs by Rev. T. S. Lea.*]

end of the tenth year. In this year we find also the commencement of the investigations by Professors Boyce and Herdman on the life conditions and health of the Oyster and the incidence and effect of certain diseased conditions. The results were communicated to successive meetings of the British Association, and were also published in the Annual Reports of our Committee. The experimental work was carried on during these years partly at Port Erin and partly in the laboratories of Liverpool University.

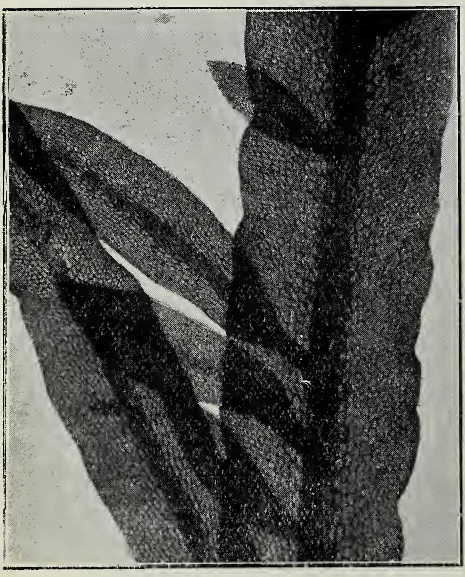


Fig. 7. *Delesseria hypoglossum*, magnified.

Fig. 8. *Himanthalia lorea*, showing the button-like fronds and the thong-like fructification.

It is unnecessary to record year by year the dredging and collecting expeditions and the various additions made to the fauna. Lists of them will be found in the successive Reports. But it may be mentioned that about this time Mr. Andrew

Scott, Assistant Naturalist on the staff of the Lancashire Sea-Fisheries, became very active in investigating the Copepoda along with Mr. Thompson, and added many rare and some new species to our lists. Some examples of the assemblages of animals found in characteristic hauls in different parts of the Irish Sea will be found in this year's Report (1895). The first given, for example, records at least 112 species belonging to 103 genera, represented by probably about 300 specimens; and many other hauls taken on the prolific ground to the west of the Isle of Man gave us on an average about 100 species. On the other hand hauls taken off the Lancashire coast in shallow water gave fewer species but far more individuals, one, for example, bringing up over 17,000 specimens belonging to 39 species.* We have other unpublished records of hauls in Liverpool Bay where the total reached such enormous numbers as from 45,000 to 50,000 specimens, not including microscopic forms. In connection with these hauls a good deal of attention was paid during this and succeeding years to the nature of the bottom and to the classification of the deposits and of the amounts of silica and calcium carbonate found in typical terrigenous and neritic deposits in the various parts of the Irish Sea.

One of the events of the following year (1896) was the visit made to the Port Erin Station by a large party (about a hundred) of biologists, including geologists and anthropologists, who had attended the meeting of the British Association in Liverpool that summer. The visitors from other countries included Professor Gilson from Louvain, Dr. Hjort from Christiania, Dr. J. G. De Man from Holland, Dr. Gilchrist from Cape Town, Professor Chodat from Geneva, Dr. Montelius from Stockholm and others.

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* *See* Lancashire Sea Fisheries Memoir, No. II, "Fishes and Fisheries of the Irish Sea," by Herdman and Dawson, 1902.

The sea-anemones of the neighbourhood, which live exceedingly well for long periods in our aquarium tanks, began to receive attention, and a first list of 21 species was published in this Tenth Report. We have since added at least eleven additional records to the Zoantharia.

The following year (1897) showed steady progress in several directions. Our fish hatching experiments were now conducted on a larger scale and dealt with the eggs of Lemon Soles, Witches and the Megrim; and suggestions and plans began to be made in regard to the Fish Hatchery which were eventually carried out in connection with the new Biological Station a few years later.

The investigations in connection with the bacteriology of the Oyster, and Mr. Lea's photographic records of organisms in their characteristic haunts on the littoral zone were also continued. Professor Ashworth started his investigation of the species of *Arenicola* which led eventually to his writing one of the L.M.B.C. Memoirs on that type. Dr. Lyster Jameson worked on Turbellaria and eventually contributed a paper on the subject to our Reports.

One of the remarkable animals dredged this year was the new green Gephyrean worm which was described in the Quarterly Journal of Microscopical Science as *Thalassema lankesteri*. It is related to *Hamingia*, *Echiurus* and *Bonellia*, and is coloured by a remarkable green pigment (thalassemin) which differs in detail from other green tegumentary pigments of allied worms.

Late in the year 1897 the Committee appointed, as Resident Curator of the Biological Station, Mr. H. C. Chadwick, A.L.S., who commenced his duties at the beginning of 1898 and has continued to occupy the post from that date to the present day. Each Annual Report from the time of Mr. Chadwick's appointment contains a report from the Curator, dealing with the numbers of students and visitors to the Station and the progress of work in the Aquarium. Mr. Chadwick also started the practice of taking meteorological observations, including the temperatures of sea and air, twice daily. These records, continued now over a period of twenty-two years, ought to be of great interest and probably some scientific value in relation to variations of the marine fauna.

The large red buoy that marks the end of the breakwater at the mouth of Port Erin Bay, and which is moored in a depth of about five fathoms, was carefully scraped in the summer of 1898 when brought ashore for its annual cleaning, and that process has been repeated on many occasions since with excellent zoological results. On that first occasion it may be noted that the assemblage of animals, amounting to over 30 species, was as follows :—*Sycon compressum*, *Bougainvillia ramosa*, *Coryne* sp., *Tubularia larynx*, *Eudendrium ramosum*, *Obelia geniculata*, *Clytia johnstoni*, *Sertularella rugosa*, *Nereis* sp., *Terebella* sp., *Sabella* sp., a Nemertine, *Bicellaria ciliata*, *Scrupocellaria* sp., *Membranipora membranacea*, several Amphipods and Isopods, *Nymphon gracile*, *Doto fragilis*, *Ciona intestinalis* (very abundant), *Ascidia mentula*, *Styela grossularia* (abundant), *Corella parallelogramma*, and at least half-a-dozen undetermined species ; while during the recent summer (1919) the species obtained on a similar occasion when we scraped the yacht moorings, close to the buoy, were as follows :—*Leucosolenia* sp., *Sycandra ciliata*, *Sagartia* sp., *Obelia geniculata*, *Eucratea chelata*, *Membranipora membranacea*, *Lepralia* sp., *Canda reptans*, *Polynoe* sp., *Nereis* sp., *Sabella pavonia*, *Spirorbis* sp., *Virbius varians*, *Hippolyte* sp., *Mysis* sp., *Galathea* sp., *Idothea baltica*, *Caprella linearis*, *Jassa falcata*, *Dexamine spinosa*, *Gammarus locusta*, *Hyas araneus*, *Phoxichilidium femoratum*, *Pecten opercularis* (young), *Anomia ephippium*, *Saxicava rugosa*, *Eolis drummondi*, *E. farrani*, *Doto fragilis*, *Hydrobia ulvæ*, *Helcion pellucidum*, *Ciona intestinalis*, *Ascidia* *aspersa*, *Botryllus smaragdus* and *B. schlosseri*—about the same total number, but rather a different assemblage of species.

It may be of interest to know that in that first year of Mr. Chadwick's curatorship the number of visitors who paid for admission to the Aquarium was 500, while in the past summer (1919) the number was over 23,000.

The work on the green colouration of certain oysters, and on the connection between oysters and certain bacterial diseases, which had been started a couple of years previously by Professors Boyce and Herdman, with the help of Dr. Charles Kohn, was continued and brought to an end during this and the following year when the detailed evidence and results were published by the Lancashire Sea-Fisheries Committee in the form of a Memoir entitled "Oysters and Disease." A summary of the results is given in our 12th Annual Report, showing that there are several distinct kinds of greenness in oysters, some of which are quite healthy, and are due to the natural vegetable food of the animal, as in the case of the green Marennes oysters in France and those of some rivers on the Essex coast; while others are diseased conditions due to the storing up of an abnormal amount of copper in the blood or other tissues. For the bacterial results we must refer those interested to the details given in the Memoir. But it may be added that our work showed the necessity for the periodic examination by scientific inspectors of all oyster beds and other grounds from which mussels, cockles or periwinkles are gathered for human food.

The Report which appeared during this year of the Manx Industries Commission recommended that a Fish Hatchery should be established in connection with the Biological Station at Port Erin. Another new departure, which was proposed in the 12th Annual Report, was the issue of a series of L.M.B.C. "Memoirs," each giving a full account, by one of our specialists, of some common and typical animal, for the use of students in University laboratories and biological stations. This series was commenced with a Memoir on "Ascidia," published in October, 1899, and has been continued for the last twenty years, twenty-three of such Memoirs having now appeared.

The following year, 1899, is noteworthy as the date of the Stockholm Conference for the purpose of initiating an International Exploration of the North Sea and neighbouring waters, in the interests of the Fishing industries. The project was advanced a stage further by the succeeding Conference at Copenhagen in 1900, and subsequently became an established convention between nine or ten of the Governments of North-west Europe, and has resulted in the publication of a very large quantity of work of a biological and oceanographic nature. In the arrangements put forward at both these original Conferences, and also in further declarations issued since, the programme of work omits any reference to the Irish Sea and the greater part of the West Coast of Scotland, which left us at any rate a free hand to continue the investigation of our own district in our own manner.* As a critic in "Nature" (November 16th, 1899) said at the time :—" With an elaborate organisation, such as that suggested by the Conference, there is a danger that the work of the biological stations would degenerate into the mere taking and recording of routine observations, whilst original work and the development of new methods of research, which are in reality of far greater importance, would receive a check. Good men would certainly not be attracted to work which consisted merely in recording observations taken according to a stereotyped plan dictated by a central bureau. A large amount of individual freedom to the workers is absolutely essential in order to secure the best results from scientific research."

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* This independent investigation of the Irish Sea was subsequently arranged and carried out in collaboration with the Lancashire and Western Sea Fisheries Committee and the Irish Fisheries Department, and periodic hydrographical cruises were made by the Lancashire Sea fisheries steamer for several years up to September, 1914. It is hoped that this work at sea will soon be resumed.

A good deal of detailed plankton work was done during this year by Mr. Chadwick and others, and we published in the 13th Report some excellent figures of larval forms of Planarians and "Tornaria," along with Holothurian, Star-fish, and other Echinoderm larvæ, which eventually led to Mr. Chadwick's L.M.B.C. Memoir on "Echinoderm larvæ."

By the following year, 1900, the first four L.M.B.C. Memoirs, dealing with "Ascidia," "Cardium," "Echinus" and "Codium," had been published, and also the fifth and last volume of the Fauna, containing reports on new Copepoda by Isaac Thompson, on Hydromedusæ by E. T. Browne, on Turbellaria by H. Lyster Jameson, and some other marine studies. At the end of the volume will be found a complete list of all the species of marine plants and animals recorded up to that date from the Irish Sea area. This list, as it gives references to the various Annual Reports or volumes of the Fauna in which the record was first made, constitutes a useful index to our faunistic publications up to this date. A list of the additions made since will be found at the end of this Report. Amongst interesting additions made to the fauna during 1900 may be noted the Nudibranchs *Doris diaphana* and *Hero formosa*, the Siphonophore *Cupulita sarsi*, the Actinians *Arachnactis albida* and *A. bournei*, and quite a number of new Copepoda recorded by Andrew Scott and Isaac Thompson. In this year's Annual Report we published the first of our series of distributional charts, Plates I. to VII., showing the physical configuration of Port Erin Bay and the neighbouring parts of the coast, and the distribution of the characteristic species of the leading groups of animals, as the result of our dredging expeditions during the preceding eight years.

The 15th Annual Report (1901) begins as follows:—

"The most important event that falls to be recorded this year is the arrangement concluded with the Government of the Isle of Man, as a result of which we shall in future occupy increased laboratory accommodation, and be responsible conjointly with a committee of the Tynwald Court for the conduct of a large Aquarium and Fish Hatchery. A detailed statement as to how this change has been brought about, as to the position of our Committee in relation to the Manx Government, and as to the probable effect upon our work will be given below. But it must be obvious to all that as this implies a removal from our present Biological Station to larger and more convenient buildings, on a better site at the other side of the bay, it is clearly the most important event in the history of the L.M.B.C. since we first established our laboratory at Port Erin."

Mr. Chadwick in this report added several species to our record, Mr. Andrew Scott gave a useful list of new fish-parasites and Crustacea, and Mr. A. D. Imms studied several kinds of shore insects in preparation for his L.M.B.C. Memoir on "Anurida" (published in 1906). The only other event of this year that need be recalled is that we prepared and published as an Appendix to the Report, and also separately, an illustrated Guide to the Aquarium, "being a short account of some of the common marine animals of the neighbourhood." This Guide, and the revised and enlarged editions which followed it, has met with much success, and many thousands of copies have been sold at 3d. each to visitors. The last 1,666 copies of the third edition have been sold during the present summer, and a new edition is now in preparation.

The 16th Report is the first of a new series recording the work done at the much larger permanent Biological Station on the south shore of Port Erin Bay. This building, combining Laboratory, Aquarium and Fish Hatchery, was erected by the Manx Government in pursuance of a report of the Industries

Commission and of an agreement between a Committee of Tynwald Court and the L.M.B.C.; and it was opened for work in the summer of 1902. The Report for that year contains a full description of the building and equipment and of the arrangement by which the Tynwald Committee and the L.M.B.C. share the expense and the control of the joint institution. The arrangement has worked smoothly and well for the last eighteen years and will no doubt continue to do so in the future under the new agreement by which the Oceanography Department of the University of Liverpool assumes the place and responsibilities of the Liverpool Marine Biology Committee.

This Report contains a first account of the local fishing industries of Port Erin drawn up by the Assistant Curator, Mr. T. N. Cregeen. As usual, additions to the recorded Fauna, made by Andrew Scott, A. D. Imms, E. T. Browne and others, will be found in the Report.

Our eighteenth year of work (1903) closed under the shadow of a recent sorrow and in presence of a serious loss. "Mr. Isaac C. Thompson has been the Honorary Treasurer and business-head of the Committee since its foundation in 1885, and his sudden death in November has left a gap in our life and work which no one man can fill. We shall be fortunate if we obtain in his successor the devoted Treasurer without requiring him to be also the accomplished Naturalist." A brief memoir of Mr. Isaac Thompson's life and work was appended to the Report. His son, Mr. Edwin Thompson, was fortunately able to take up and complete his father's work for that year, and eventually he was appointed Honorary Treasurer to the Committee and has acted in that capacity to our great satisfaction for the last sixteen years.

The 17th Report (1903) contains the first record of the remarkable swarm of the large Copepod *Calanus finmarchicus* which appears in Port Erin Bay nearly every year in July. There are also various additions to the fauna and other records

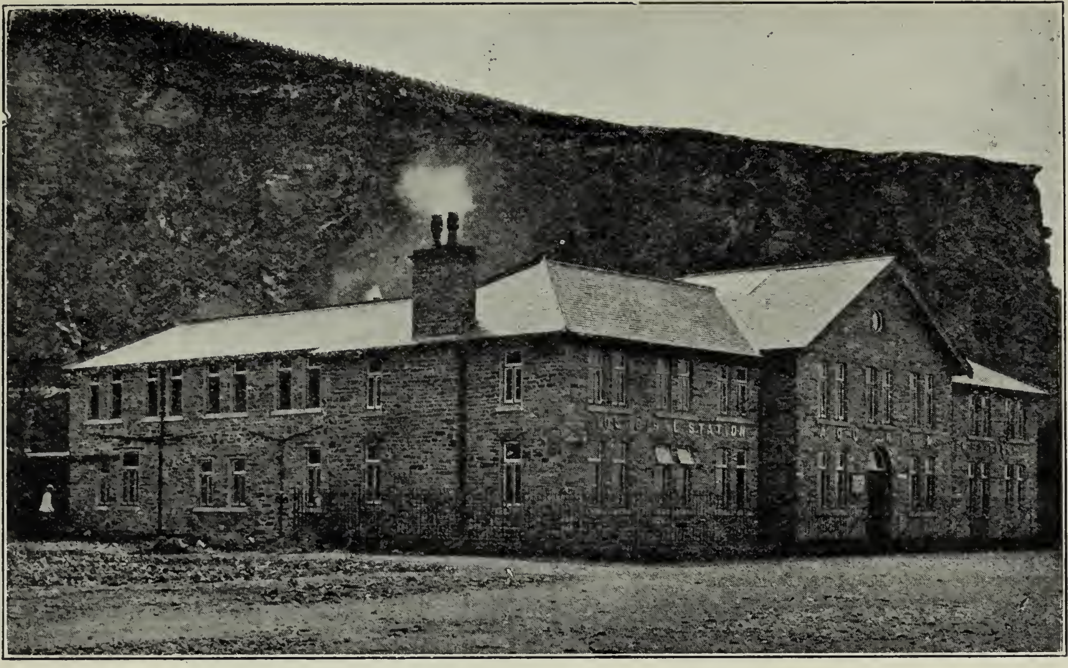

Fig. 9. The new Biological Station at Port Erin.

[*Photo. by Prof. F. J. Cole.*]

of a routine nature, and it may be noted that during this and the preceding two years the Committee issued L.M.B.C. Memoirs on "Alcyonium," "Lepeophtheirus" and "Lernæa," "Lineus," "Pleuronectes," "Chondrus," and "Patella."

Each successive year now began to show an increase in the number of investigators doing original work at the new Laboratory, and an increased interest in the public as shown by the numbers of visitors to the Aquarium. Each year also showed important additions to the accommodation and equipment at the Station, such as the addition of a second storage tank on the cliff behind, improvements in the Fish hatching and in the circulation of water in the Aquarium tanks and in the facilities for students' work. "Many of our Univer-

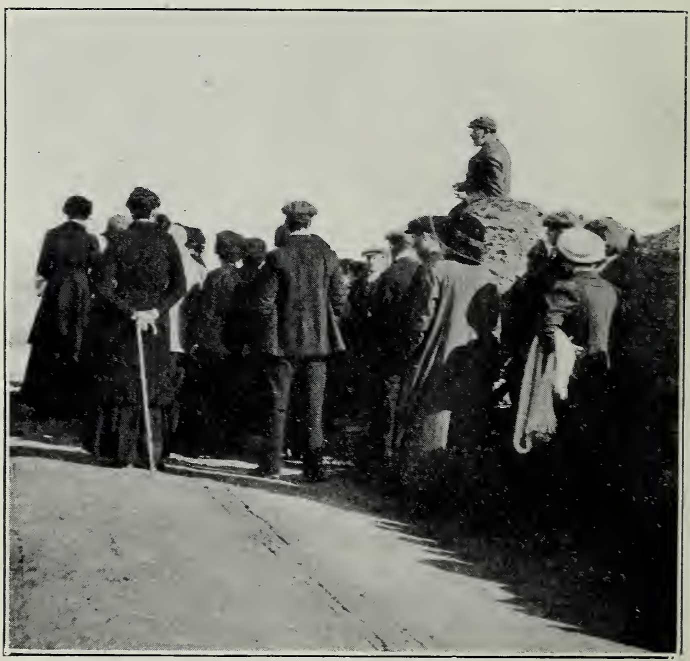

Fig. 10. Students at a field-demonstration.

[*Photo. by Prof. W. J. Dakin.*

sity students have supplemented their biological work in the Laboratory with occasional days devoted to Geology and Archæology on the hills. On some of these occasions we have had the advantage of being accompanied by Mr. Lomas as our leader amongst the rocks, and by Mr. Kermode when examining the pre-historic antiquities. From time to time I have been enabled to take part with Mr. Kermode in the examination or exploration of some of the early Manx remains.

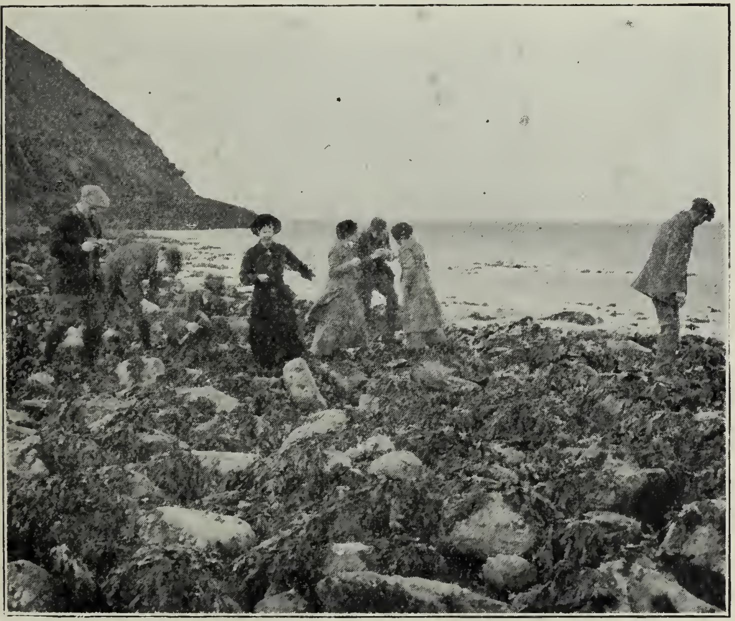

Fig. 11. Shore collecting at Fleshwick Bay.
[*Photo. by Prof. F. J. Cole.*

The most notable of these occasions was when, some twelve years ago, we excavated the large circle of stone cists on the Meayll Hill above Port Erin, and the foundations of the neighbouring hut villages. The paper that we wrote on the results of our digging has now been long out of print, and the single copy at Port Erin has been frequently consulted and taken out on loan. Consequently, we have now been induced, by many demands from our students and from visitors at the Biological Station, to reprint our former paper, with considerable additions, so that it may constitute an illustrated guide to the more important of the ancient monuments and other remains on the island—and in this form it will be found appended to the present Report" (18th Report, for 1904).

The Report contains also some interesting biological observations, such as Dr. Ashworth's discovery of young specimens of the curious partly parasitic Copepod *Monstrilla* in specimens of the small tubicolous worm *Salmacina* obtained on the ruined breakwater, the finding by Mr. A. D. Imms of a pseudo-scorpion *Obisium maritimum* which has otherwise only been recorded from the coast of Devon, the report by Mr. A. Scott on the fish eggs and larvæ obtained in the Port Erin tow-nettings, and Mr. Chadwick's careful drawings of the characters seen after each moult in the development of the lobster.

Twelve L.M.B.C. Memoirs—the last two being "Arenicola" by Dr. Ashworth and "Gammarus" by Miss Cussans—had now (1904) been published and another dozen or so (most of which have since appeared) were announced as in progress. This series of detailed studies of useful common types seems to be meeting with general approval in University laboratories.

The 19th Annual Report (1905) contained the second (revised and enlarged) edition of the "Guide to the Aquarium," and it may be noted that this year the number of visitors had increased to over 13,000. We may fairly claim that by means of the exhibition tanks and the Aquarium Guide our Institution is doing some educational work in spreading a knowledge of marine biology and encouraging nature-study amongst the inhabitants and summer visitors of an important sea-side resort. The total number of visitors to the Aquarium from August, 1902, to November, 1919, is 204,553.

This year saw the commencement of the bio-chemical work by a team of investigators under the leadership of Professor Benjamin Moore, which has been continued at intervals ever since and has resulted in the publication of a number of interesting papers in the Proceedings of the Royal Society and in the Bio-Chemical Journal. The earlier work dealt with the effect of slight changes in the alkalinity of sea-water in the nuclear division and embryonic development of marine animals, and later investigations included experiments in photosynthesis and in the nutrition of marine animals.

It may be appropriate to add that the Report for this year contained a description of the new Zoology Buildings of the University of Liverpool and of the proceedings that took place at the formal opening by the Earl of Onslow (then President of the Board of Agriculture and Fisheries) when Sir John Murray gave a short address on Oceanography in the Zoology Lecture Theatre. These buildings have constantly been the Liverpool centre of all our work from that time up to the present, and will continue to be so as the seat of the Oceanography department which takes over our work.

The following year, 1906, is noteworthy as being the first in which I tried the experiment of having a small steam yacht of my own at Port Erin during the summer, constantly employed in making collections and taking observations at sea. This proved so successful that the practice was extended in the following year to the Easter vacation as well as the summer, and the work from the successive yachts* ("Madge," "Ladybird" and "Runa"), in which I was most ably assisted by various friends, colleagues and senior students, was kept up with great activity until the year of the war, and to a considerable extent took the place of our earlier dredging expeditions in hired steamers. In this first year of such work I had chartered a small steam vessel, the "Madge," which lay at moorings in Port Erin Bay during the summer and was used almost daily in suitable weather for dredging expeditions in the neighbourhood, and more especially for taking a series of plankton observations with various kinds of tow-net at different fixed stations periodically and as frequently as possible.

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* To avoid any misunderstanding in the future and to correct certain erroneous reports, I think it best to state definitely once for all that these yachts were my own private property, and although used freely for the service of the Biological Station and to help the work of the Manx Fishery Board they were run entirely at my own expense. It has been a pleasure and a privilege to be able to help on the work in this manner; but this personal statement seems necessary in view of ill-informed newspaper reports.

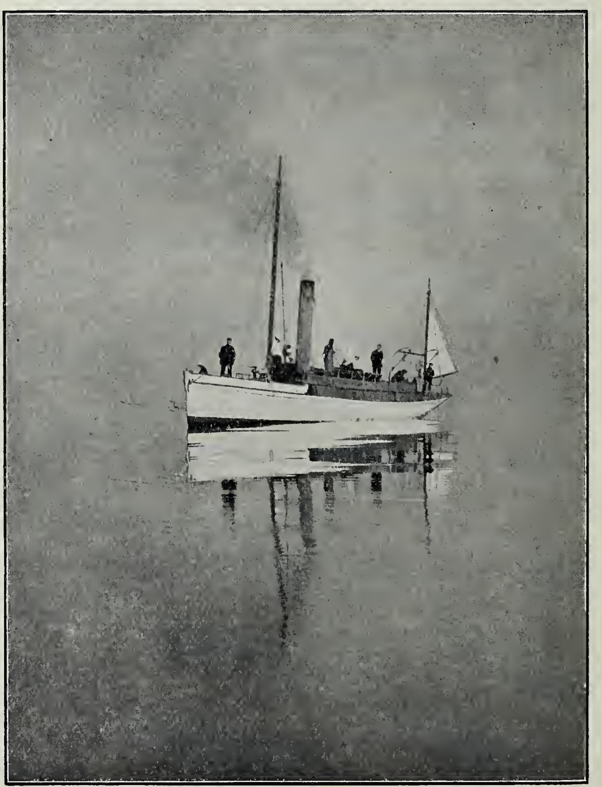

Fig. 12. S.Y. "Ladybird" on a Plankton cruise at Easter, 1908.

[*Photo. by Edwin Thompson.*

This led in the following year to a systematic investigation which we called the "Intensive Study of the Plankton," and which has been continued from 1907 onwards to the present time, annual accounts of the results being given in the Lancashire Sea-Fisheries Reports. The chief results of the plankton gatherings made in the summer of 1906 from the "Madge" are given by Mr. Andrew Scott in an Appendix to this 20th Report.

We find in the Curator's report for 1906 that 15,000 visitors paid for admission to the Aquarium at the Biological Station. This brings up the total number of visitors admitted during these four years since the opening of the new Station to over 50,000. Amongst many animals of interest which are recorded as having appeared spontaneously in our Aquarium tanks during this or succeeding years may be noted the following:—large colonies of *Halichondria panicea* up to 16 inches by 8 inches, the compound Tunicate *Botryllus smaragdus*, the beautiful tube-building Polychæt worm *Sabella pavonia*, extensive colonies of the Hydroid *Podocoryne carnea*, multitudes of the Medusoid *Sarsia tubulosa* (probably derived from a species of *Syncoryne* growing in quantity in the suction pipe through which the supply of water is drawn from the sea), the Polyzoon *Pedicellina cernua* in colonies of large extent, and dense aggregations of the little tubicolous worm *Filograna implexa*—these being in addition of course to the many kinds of Invertebrates and Fishes which are captured and placed in the tanks by the Curator and his Assistant.

The success of the work done at sea from the small chartered steamer "Madge" during the summer of 1906 led to the purchase early in 1907 of the S.Y. "Ladybird" (36 tons and about 70 feet over all), which was constantly at work during the Easter and summer vacations of this and the following three years. This yacht proved very suitable for our work and was fitted up with a dredging derrick forward and a full equipment of tow-nets and small fish trawls of various kinds which were worked over the stern. She was also provided with a Lucas sounding machine, an Ekman current meter, and the usual water bottles and deep-sea thermometers, which were worked over the rail amidships. The plankton results are given in considerable detail in the Report for this year.

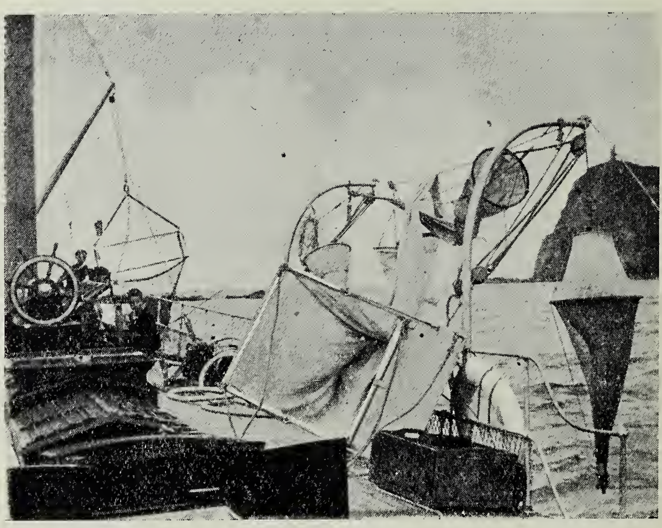

Fig. 13. Equipment of Plankton nets, etc., on board the "Ladybird."
[*Photo. by Mr. R. Okell.*

During this and following years Professor B. Moore and Dr. Roaf continued their researches in various departments of Bio-chemistry, including the digestive ferments of invertebrates, the secretion of the hypobranchial glands of Mollusca and the bio-chemistry of the blood and other tissues of Pecten.

Notable additions to the local fauna exhibited in the Aquarium were the Lucernarian *Haliclystus auricula*, the Anemones *Aureliana augusta*, *Corynactis viridis*, *Sagartia rosea*, *S. herdmani*, *Bunodes thallia*, *Stomphia churchiæ* and a young *Cerianthus*, and the beautiful little coral *Paracyathus pteropus*.

Lobster culture was started in the Hatchery in the summer of 1907. Some thousands of larvæ were hatched and set free in their first and second stages and about 80 were reared to the lobsterling stage. This work has been continued in each successive year up to the present, and many experiments have been made by the Curator and his assistant as to the best methods of keeping the adult "berried" lobsters, and of rearing and feeding the larvæ, which will be found recorded in the various Annual Reports.

Mr. F. H. Gravely from the University of Manchester made notable faunistic investigations during the summer of 1907 and added many rare and interesting forms to our list, including the Tornaria larva of *Balanoglossus* which we have never succeeded in finding in the adult condition. Mr. Gravely eventually contributed a useful Memoir on "Polychæt Larvæ" to our series.

In the following Report, for 1908, we published a full description of the hatchery arrangements, the circulation of the water, the mechanism of the hatching-boxes by means of which they are alternately raised and then depressed through a few inches so as to keep their contained eggs in constant motion, the method of filtering the water and other details. From this time onwards the work in the Hatchery went on steadily year by year, plaice being dealt with during the spring, February to May, and lobster larvæ being reared during the summer, July to September. The numbers of millions of plaice and of thousands of young lobsters have varied from year to year (up to about eight million plaice and five thousand lobsters), and the whole of the work must still be regarded as experimental, as an attempt to find out what are the best conditions under which such operations can be carried on, and what measure of success it can be reasonably hoped to attain. On one point, however, there can be no doubt, and that is that the young fish hatched under artificial conditions are no weaklings but are perfectly capable of growing up to the adult state and of producing young in their turn. Later on, in the year 1917, we recorded that "we now have fish producing fertile spawn, which were themselves hatched and reared in our Institution three years ago. There are about 20 of these belonging to the hatching season of 1914, and, therefore, now just three years old, and measuring on the average 10½ inches in length, which have been kept separate since the summer of 1914, and this is probably a record both as to the small size and the young age at which the plaice can spawn; and it is also probably the first time that the second generation of this fish has been produced and reared in captivity." Three generations of the fish were living in our hatching tanks in 1918, under Mr. Cregeen's careful management.

During these same years, from 1907 onwards, we had one or other of the yachts, "Ladybird" and "Runa," constantly at work during the Easter and summer vacations in the seas around Port Erin, and each of the Annual Reports for this period will be found to give details of the various kinds of experimental nets used and the results obtained in the intensive study of the plankton. The following passage may be quoted from the Report for 1908 as giving some idea of the complexity of the causes of the very marked variation in the abundance and nature of the plankton from time to time:—

"It is clear that some of the great seasonal variations in the plankton are not due to changes in the sea-water such as are recognised in hydrographic observations, but are caused simply by the normal sequence of stages in the life-histories of organisms throughout the year. No amount of 'hydrographic' change in the water will determine the presence of Echinoderm larvæ at a time of year when they are not produced, nor of Crab Megalopas when they do not naturally occur.

"Three factors, at least, contribute to the constitution of the plankton from day to day throughout the year:—

(1). The sequence and periodicity of stages in the life-history of the organisms ;

(2). Irregularities due to the inter-action of organisms, as when one group serves as the food of another ;

(3). Periodic changes and abnormalities of either time or abundance caused by the nature of the sea-water or by weather conditions which may either determine or prevent the normal or permit of an abnormal development of certain species.

" The appearance of swarms of Balanoid Nauplii, followed after an interval by the ' Cypris ' stage, is an example that comes under the first head. The disappearance of Diatoms when used as food by the increasing swarms of Copepoda and other Crustacea, both larval and adult, and of the Copepoda in turn when eaten by the developing post-larval fish, are changes falling under the second head. The great increase in the number of Diatoms in spring, when the physical condition of the sea-water has become favourable, the enormous development of Dinoflagellates which may take place suddenly in autumn under unusual weather conditions, the almost total suppression of a group such as the Medusae in some localities in an unusually stormy summer, and the immigration of a species or a group of species from the open ocean or from a neighbouring sea-area as the result of variations in the hydrographic conditions, are all examples that may be classed in the third category.

" Two or all of these factors may, however, be at work together, and so the explanation of any particular change may be a very complicated problem. The increased development of a group, or the immigration of a species, may so disturb the balance of nature as to be followed by unusual changes in other groups."

It would be very difficult to summarise all the plankton results obtained during the past thirteen years—when some

6,000 hauls have been taken, carefully analysed, and the results fully discussed in a series of special reports on this "Intensive Study of the Plankton" which have been laid before and published by the Lancashire Sea-Fisheries Committee.

The following instance gives an example of local distribution of an organism in swarms, and of the erroneous conclusions that might be drawn from imperfect or incomplete observations:

"We were fortunate enough on one occasion to obtain incontrovertible evidence of the sharply defined nature of a shoal of organisms, forming an instructive example of how nets hauled under similar circumstances a short distance apart may give very different results. On the evening of April 1st (1907), at the 'alongshore' Station III., north of Port Erin, off the 'Cronk' one mile out, I took six simultaneous gatherings in both surface and deeper waters. Two of the nets were the exactly similar surface tow-nets which I have called B and C. At half-time, as the result of a sudden thought I hauled in B, emptied the contents into a jar, and promptly put the net out again. This half gathering was of very ordinary character, containing a few Copepoda, some Diatoms and some larvæ, but *no Crab Zoëas*. At the end of the 15 minutes, when all the nets were hauled on board, all the gatherings, including B, showed an extraordinary number of Crab Zoëas rendering the ends of the nets quite dark in colour. B was practically the same as C although B had only been fishing for seven minutes. It was evident that at about half-time the nets had encountered a remarkable swarm of organisms which had multiplied several times the bulk of the catch and had introduced a new animal in enormous numbers. Had it not been for the chance observation of the contents of B at half-time, it would naturally have been supposed that, as all the nets agreed in their evidence, the catches were fair samples of what the water contained over at least the area traversed—whereas we now know that the Zoëas were confined to at most the latter half of the traverse and may have been even more restricted. Under these circumstances, an observation made solely in the water traversed during the first seven minutes would have given a very different result from that actually obtained ; or, to put it another way, had two expeditions taken samples that evening at what might well be considered as the same station, but a few hundred yards apart, they might have arrived at very different conclusions as to the constitution of the plankton in that part of the ocean."

" The Nauplius and Cypris stages of *Balanus* form an interesting study. The adult Barnacles are present in enormous abundance on the rocks of Bradda Head, and they reproduce in winter, at the beginning of the year. The newly-emitted young are sometimes so abundant as to make the water in the shore pools appear muddy. The Nauplii first appeared in 1907 in the bay gatherings on February 22nd (in 1908 on February 13th), and increased with ups and downs to their maximum on April 15th. and then decreased until their disappearance on April 26th. None were taken at any other time of the year. The ' Cypris ' stage follows on after the Nauplius. It was first taken in the bay on April 6th, rose to its maximum on the same day with the Nauplii, and was last caught on May 24th. Throughout, the ' Cypris ' curve keeps below that of the Nauplius, the maxima being 1,740 and 10,500 respectively. Probably the difference between the two curves represents the death-rate of *Balanus* during the Nauplius stage."

Our reports for the last twelve years fall naturally into two categories—the pre-war series which, from 1907, are largely occupied by the plankton investigations, increasing in intensity and in the variety of experimental nets made use of year by year, and, secondly, the four reports from 1915 onwards which, on account of the restrictions necessarily put upon our work at sea, were devoted in part to laying before our fellow workers and students short oceanographic studies upon the three

British pioneers Edward Forbes, Wyville Thomson and John Murray, and a final discussion of some recent bio-chemical results as affecting the metabolism of the seas in our own neighbourhood.

It will not be necessary to refer to each of these reports in detail, but it may be noted that those for 1909 and the few following years record various investigations, both morphological and physiological, undertaken by some of our younger adherents, such as Dr. W. J. Dakin, Dr. J. Pearson, Mr. W. Riddell, Mr. R. D. Laurie and Dr. H. E. Roaf.

In 1910 we added a new research wing to the building, measuring 44 feet by 18 feet, and two storeys high, which provided a useful tank room on the ground floor opening into the back yard, and a series of eight small work-rooms for researchers above. Our records show that we have had 419 workers in the present Biological Station since 1902; and the total number of workers from the Puffin Island days onwards has been 506.

This year is also notable as being that in which we held at Port Erin in the summer a first course of lectures, demonstrations and practical work dealing with Oceanography from both the hydrographical and biological points of view, full details of which are given in the 24th Report, and in conducting which I had the able assistance of Dr. Dakin and Dr. Roaf.

" Oceanography—the science of the sea—has for its scope the determination of the physical, chemical, and biological characters of the oceans of the world, and of the cause of those great seasonal variations in the microscopic living contents upon which depend man's supply of food from the sea, and the continuance of many human industries. There are scarcely any more wide-spread phenomena in nature, and probably none of more importance to man, than those vast periodic changes in the minute organisms of the sea, the causes of which are now being sought by oceanographers both on exploring vessels and in the laboratories of Biological Stations and Universities of all civilised countries."

This was the year of the foundation of the great Museum of Oceanography at Monaco, and if this modern science of the sea has now reached such an advanced stage that it can be demonstrated in a museum to the public, it is clearly desirable that it should be taught both theoretically and practically in our Universities and at Biological Stations. There must be many young biologists and other teachers who desire to learn something of the methods of investigation and the results obtained, by direct contact with the material and the apparatus

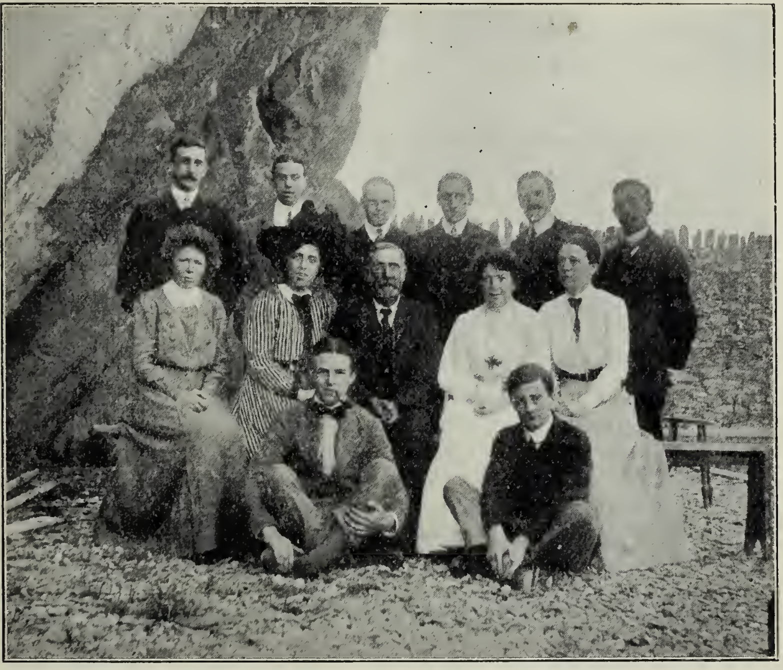

FIG. 14. The first Oceanography class at Port Erin, August, 1910.

[*From a photo. by H. E. Roaf.*

at some institution where oceanographical research is now being actively carried on.

During these years several of our younger Zoologists were working at L.M.B.C. Memoirs which have since been published. These include "Pecten" and "Buccinum" by W. J. Dakin, "Eupagurus" by H. G. Jackson, "Ligia" by C. G. Hewitt, "Cancer" by J. Pearson, "Antedon" by H. C. Chadwick, and "Eledone" by A. Isgrove. "Tubifex" our last published Memoir, by G. C. Dixon, appeared in 1915.

About this time several of our bio-chemists, including Professor B. Moore and Dr. Dakin, made elaborate investigations for the purpose of testing the figures recently put forward by Pütter and others as to the insufficiency of the plankton to serve as food for marine animals. The primary objects of these investigations were (1) to determine the amount of organic carbon present in solution in sea-water, (2) to determine the amount of the same substance present in the plankton, and (3) to estimate the amount of organic carbon required per day for the nourishment of selected marine animals. Professor Moore reported :—

"The results show conclusively that the amount of dissolved organic carbon present in the sea-water is almost negligible (lying well below one milligram per litre of water), and that Pütter's figures are very incorrect. It has also been shown that the amount of plankton normally present and distributed through the water is practically just as insufficient to provide food if the sea-water is merely filtered, as it comes, by a marine animal. Organic matter in solution and plankton together do not seem present in sufficient quantity for the nutrition of active marine animals, unless they hunt their food or frequent the zones where plankton is especially abundant."

Further work at Port Erin since has shown that, while the plankton supply as found generally distributed might prove sufficient for the nutrition of such sedentary animals as Sponges and Ascidians, it is quite inadequate for active animals such as Crustaceans and Fishes. These latter are, however, able to seek out their food and are not dependent on what they may filter or absorb from the sea-water. This result accords well with our many observations on the irregularity in the distribution of the plankton and the corresponding variations in the occurrence of the migratory fishes which may be regarded as following and feeding upon the swarms of planktonic organisms.

Several of the reports during this period deal also with observations on the minute life found in the sand and mud of the sea-beach and its variations from time to time. Perhaps the most remarkable observation in this respect was the discovery that the Dinoflagellate *Amphidinium operculatum*, hitherto unknown in British seas, occurred from time to time in enormous profusion on certain parts of the shore at Port Erin. Although occasionally not present, it has continued to reappear since the time of its first discovery in 1911 year by year, and has been kept in quantity in the living condition in our laboratory tanks for the benefit of the students. A full account of the occurrence and the variations of this interesting organism will be found in the 25th and 26th Annual Reports. Since its discovery at Port Erin it has been found in quantity at such distant parts of the British Coast as Hoylake, Blacksod Bay, Cullercoats and Iona.

During some of the years preceding 1914, when we had the yachts "Ladybird" or "Runa" in commission during the summer vacation, it seemed desirable to extend our planktonic work northwards from the Irish Sea to the west coast of Scotland and the Hebrides. Twelve such cruises were undertaken, seven in the "Ladybird" and five in the "Runa," and the results are summarised in our Annual Reports for 1910 to 1913. These Scottish observations extend as far North as the Shetland Islands and as far West as the open Atlantic to the South-West of Barra Head, and have yielded material for about a dozen detailed papers published by our own Society, the Linnean Society of London and elsewhere. One of the most notable of these is the report by Messrs. E. Heron-Allen and A. Earland on the Foraminifera, from which the accompanying beautiful illustrations are taken (Fig. 16). Mr. Heron-Allen also identified a series of 112 species of Foraminifera dredged off Bradda Head in 20 fathoms, the list of which will be found in our 28th Report. Mr. Wm. Riddell, while acting as my Scientific Assistant on the yacht, drew up with me a series of reports on the planktonic results of the cruises, which are published in the Journal of the Linnean Society.

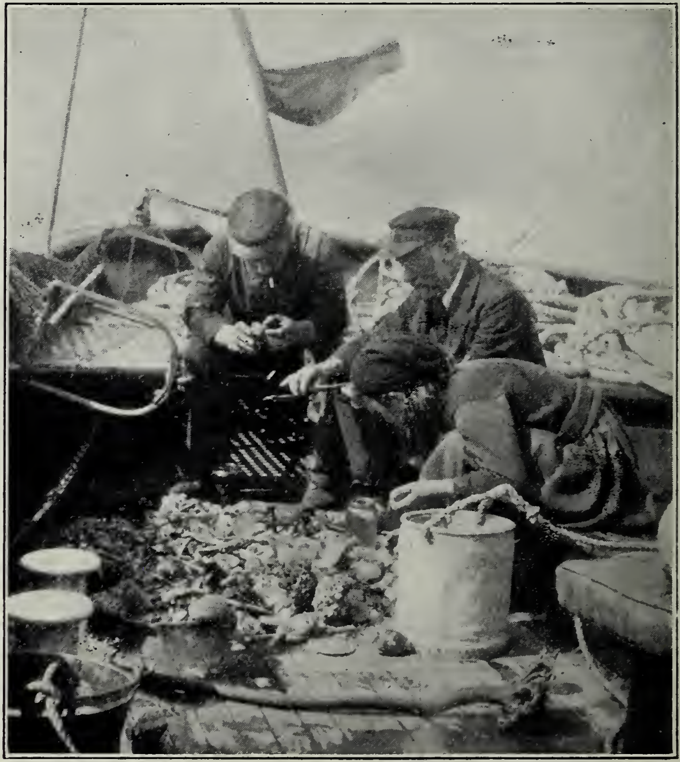

Fig. 15. Examining the catch on the deck of the "Runa."

In conclusion it is only right to point out that the series of Annual Reports which has now been briefly summarised does not adequately represent all the work carried out under

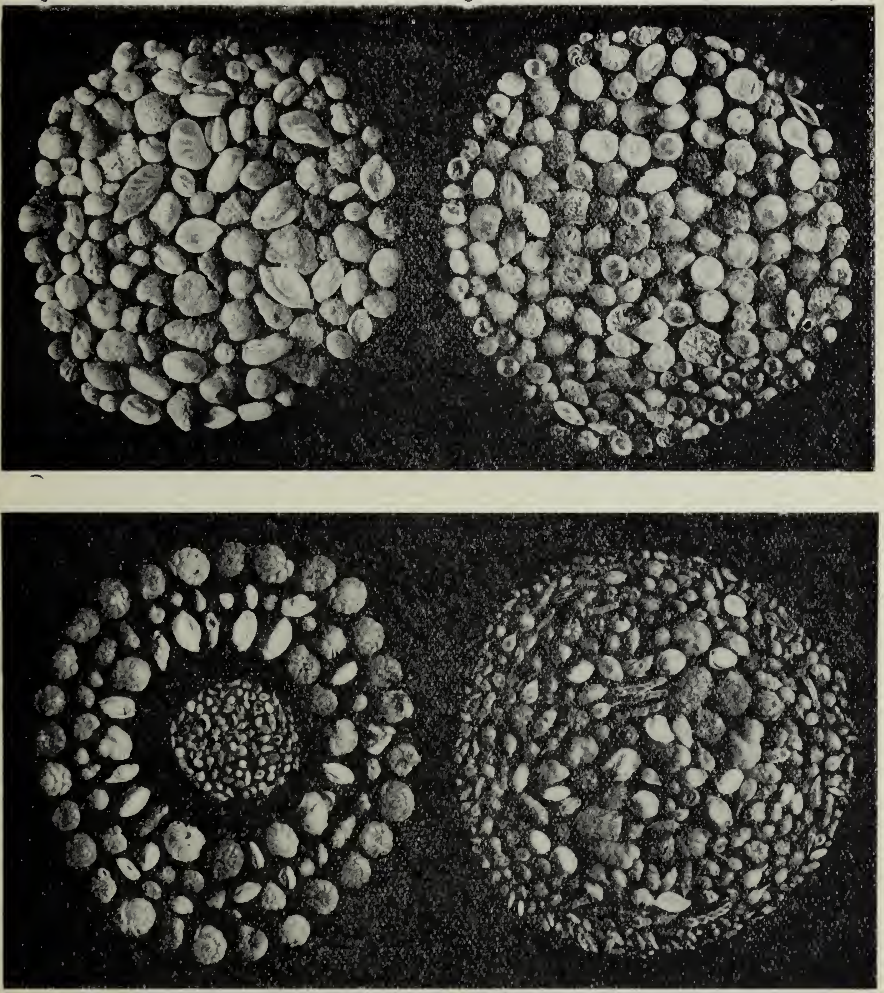

Fig. 16. Four samples of Foraminifera gatherings from dredgings off the West Coast of Scotland. [*Photo. by A. E. Smith.*

the auspices of the Liverpool Marine Biology Committee at Puffin Island, Port Erin and Liverpool during its 35 years of activity. Many of the workers in the Biological Station, in the

University laboratories or in the field have not been referred to in this brief summary, and for details of the work done reference must, of course, be made to the series of L.M.B.C. Memoirs and to the other papers of the various investigators, which are for the most part published elsewhere.

Let me add my conviction that the history of the Liverpool Marine Biology Committee has shown clearly the advantage of "team-work" in this department of science. No one man or even two or three men could undertake a marine biological survey—still less its modern extension the complete Oceanographic investigation of an area. It is only by the co-operation of many minds and hands and by the co-ordination of their varied activities that we can hope to gain that adequate and well-proportioned knowledge of the animals and the plants, and the effect upon them of their physical environment, towards which we of the Liverpool Committee hope that our work has made some contribution.

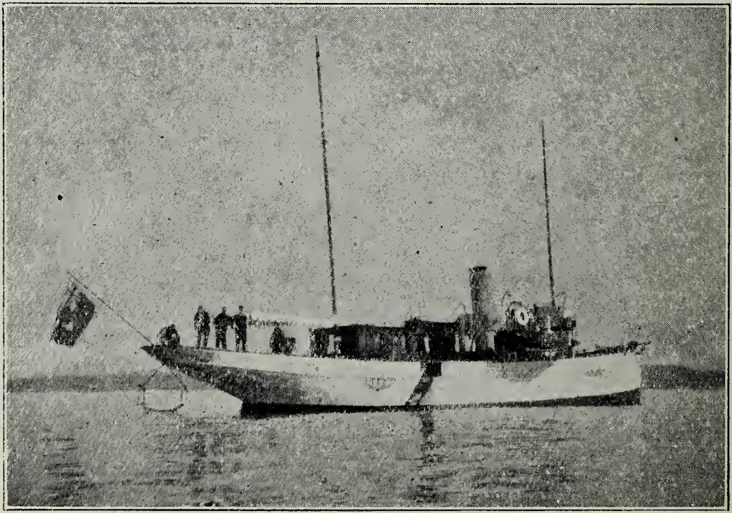

Fig. 17. S.Y. "Runa" with the "Agassiz" dredge coming up at the stern.

APPENDIX B.

List of species* recorded by the L.M.B.C. since the publication of their British Association List in 1896.

DIATOMACEA.

Asterionella japonica.
Biddulphia sinensis.
Chœtoceras contortum.
C. criophilum.
C. debile.
C. decipiens.
C. densum.
C. sociale.
C. teres.
Coscinodiscus grani.
Coscinosira polychorda
Ditylium brightwelli.
Guinardia flaccida.
Lauderia borealis.
Rhizosolenia semispina.
R. stolterfothii.
R. alata.
Streptotheca thamensis.
Thalassiosira gravida.
T. nordenskioldi.
T. subtile.

SPOROZOA.

Merocystis kathae, Dakin.
Glugea stephani, Hagenm.
Sphaerospora platessa, Woodcock.
Lymphocystis johnstonei, Woodcock.
Myxobolus esmarkii, Woodcock.
Ichthyophthirius multifiliis, Fouquet.

FORAMINIFERA.

Biloculina bulloides.
Miliolina circularis.
M. seminuda.
M. candeiana.
M. laevigata.
M. brongniartii.
M. rotundata.
M. bosciana.
M. pygmaea.

Foraminifera—*continued.*

Ophthalmidium carinatum.
Cornuspira selseyensis.
Bathysiphon argenteus.
Haplophragmium pseudospirale.
Textularia conica.
Spiroplecta wrightii.
Bolivina textilarioides.
Cassidulina subglobosa.
Nodosaria consobrina.
Polymorphina amygdaloides.
Discorbina mamilla.
D. praegeri.
D. obtusa.
Truncatulina variabilis.
Pulvinulina oblonga.
P. haliotidea.
Rotalia orbicularis.
R. perlucida.
Polystomella macella.
Operculina ammonoides.

DINOFLAGELLATA.

Amphidinium operculatum.

HYDROIDA.

Rhizogeton fusiformis.
Podocoryne carnea.
Cuspidella costata.
Campanularia repens.

SIPHONOPHORA.

Cupulita sarsi.

SCYPHOMEDUSAE.

Pelagia perla.

ZOANTHARIA.

Edwardsia carnea.
Ilyanthus mitchellii.

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* I am indebted to Mr. Scott for the list of Diatomaceæ, which he has identified from our Port Erin tow-nettings, and for the lists of Copepoda and some other groups of the Crustacea.

Dr. Johnstone has supplied the lists of Sporozoa and of Parasitic Worms, some of them new species, the descriptions of which will be found in the Reports to the Lancashire Sea-Fisheries Committee.

Zoantharia—*continued.*

Arachnactis albida.
A. bournei.
Aureliana augusta.
Bunodes thallia.
Stomphia churchiæ.
Peachia hastata.
Urticina eques, Gosse.
Paracyathus pteropus.
Caryophyllia smithi.

TURBELLARIA.

Polycelis nigra.
Promesostoma agile.
Mesostoma neapolitana.
Macrorhyncus croceus.
Provortex affinis.
Grafilla buccinicola.
Plagiostoma koreni.

TREMATODA.

Axine bellones.
Callicotyle kroyeri.
Dactylocotyle pollachii.
Diplectannum aequans.
Microcotyle labracis.
Onchocotyle appendiculata.
Octobothrium alosae
O. merlangi.
O. scombri.
Phyllocotyle gurnardi.
Phyllonella soleae.
Placunella pini.
Distomum valdeinflatum, Stossich.
D. appendiculatum, Rud.
D. gulosum, Linton.
D. ocreatum, Molin.
D. vitellosum, Linton.
D. mollissum, Levinsen.
D. rufoviride, Rud.
Gasterostomum gracilescens (Rud.).
Cercaria fissicauda, La Val.
Echinostomum imbutiforme, Molin.
Derogenes varicus (O. F. M.)
Allocreadium labracis (Duj.)
Zoogonides viviparus (Olsson).
Lebouria idonea, Nicoll.
Paracotyle caniculae, Johnst.
Koellikeria filicolle (Rud.).
Didymozoon scombri, Tasch.
Gyrodactylus elegans, Nordm.

CESTODA.

Dibothrium punctatum, Rud.
D. crassiceps, Rud.
Abothrium rugosum (Goetze).
Tetrarhynchus tetrabothrius, van Ben.
T. erinaceus, van Ben.

Cestoda—*continued.*

T. van benedeni (Crety).
Phyllobothrium lactuca, van Ben.
P. thridax, van Ben.
Echeneibothrium variabile, van Ben.
E. dubium, van Ben.
Oncobothrium uncinatum, Rud.
Acanthobothrium coronatum, Rud.
Calliobothrium verticillatum, Rud.
C. eschrichtii, van Ben.
Crossobothrium laciniatum, Linton.
Anthobothrium auriculatum, Rud.
A. musteli, van Ben.
Echinobothrium affine, Diesing.
Prosthecobothrium dujardinii, v. Ben.
Rhinebothrium minimum (van Ben.).
Coenomorphus linguatula (van Ben.).

CESTODARIA.

Gyrocotyle urna, Grube and Wag.

ACANTHOCEPHALA.

Echinorhynchus acus, Rud.

NEMATODA.

Rhabditis sp.
Spilophora sp.
Dorylaimus sp.
Oncholaimus sp.
Enoplus sp.
Plectus sp.

HIRUDINEA.

Platybdella soleae.
Trachelobdella lophii.
Pontobdella laevis (Blainv.).

GEPHYREA.

Sipunculus bernhardus.
Thalassema lankesteri.
Priapulus caudatus.

POLYCHAETA.

Syllis sp. (? young *monilaris*).
S. cornuta.
S. krohnii.
Pionosyllis lamelligera.
Odontosyllis ctenostoma.
Trypanosyllis rebra.
Autolytus incertus.
A. longisetosus.
Myrianida pinnigera.
Sphærodorum sp.
Magalia perarmata.
Polynoe reticulata.
P. semisculpta.
Notophyllum foliosum.

Polychaeta—*continued.*

Staurocephalus sp.
Ophryotrocha puerilis
Nematonereis sp.
Glycera alba.
G. lapidum.
G. siphonostomata.
Aricia cuvieri.
Scolopus (*Theodisca*) *mamillata.*
Polydora cœca.
P. flava.
Scolecolepis fuliginosa.
Chœtopterus variopedatus.
Dodecaceria (? *concharum*).
Melinna cristata.
Praxilla gracilis.
Amphiglena mediterranea.
Arenicola grubii.
Eumenia sanguinea.
Potamilla reniformis.
P. torelli.
Myxicola infundibulum.
Salmacina dysteri.
Flabelligera affinis.
Gattiola finmarchica.

POLYZOA.

Mucronella peachii, var. *labiosa*
M. abyssicola.
Hippothoa flagellum.
Cylindroccium pusillum.
Pedicellina gracilis.

CRUSTACEA—BRACHYURA.

Gonoplax angulatus.
Dromia vulgaris.

MACRURA.

Athanas nitescens.
Callianassa subterranea.
Jaxea nocturna (larvæ).
Upogebia stellata.

SCHIZOPODA.

Mysis longicornis.
Schistomysis arenosa.
Erythrops erythrophthalmus.
E. serrata.
Siriella armata.

STOMATOPODA.

Squilla desmarestii (larvæ).

CUMACEA.

Eudorellopsis deformis.
Eudorella emarginata.
Campylaspis glabra.
Cumella pygmaea.
Pseudocuma similis.

ISOPODA.

Apseudes hibernicus.
Dajus mysidis.
Eurydice inermis.
E. spinigera.
E. truncata.
Gnathia dentata.
Idothea balthica.
I. granulosa
I. pelagica.
Tanais cavolinii.

BOPYRIDÆ.

Pleurocrypta porcellanae.

AMPHIPODA.

Iphimedia eblanæ.
Stenothoë crassicornis.
Gammarus duebeni.
Halimedon parvimanus.
Normanion quadrimanus.
Argissa hamatipes.
Janiropsis breviremis.

OSTRACODA.

Cythere pellucida.
C. porcellaneæ.
C. gibbosa.
Cytheropteron humile.
Asterope mariæ

COPEPODA.

Microcalanus pusillus.
Stephus gyrans.
Candacia armata.
Pontella lobiancoi.
Stenhelia intermedia.
Ameira exilis.
A. intermedia.
Delavalia mimica.
Canthocamptus parvus.
Mesochra propinqua.
Itunella tenuiremis.
Clytemnestra rostrata.
Idya minor.
Heteropsyllus curticaudatus.
Laophonte denticornis.
Leptopsyllus herdmani.
L. intermedius.
Thaumaleus thompsoni.
Corycaeus anglicus.
Oncaea minuta.
O. subtilis.
Giardella thompsoni.
Lichomolgus hirsutipes.
Hersiliodes littoralis.
Enterognathus comatulæ.

COPEPODA (parasita).

Nicothoe astaci.
Bomolochus soleae.
Caligus brevicaudatus.
C. diaphanus.
C. gurnardi.
C. labracis.
C. minimus.
C. pelamydis.
C. zei.
Pseudocaligus brevipedes.
Lepeophtheirus pollachii.
Trebius caudatus.
Echthrogaleus coleoptratus.
Pandarus bicolor.
Dichelestium oblongum.
Lernanthropus kroyeri.
Hatschekia labracis.
H. pygmaea.
Kroyeria lineata.
Congericola pallida.
Eudactylina acanthii.
E. acuta.
E. insolens.
Lernaea lusci.
L. minuta.
Haemobaphes cyclopterinus.
Lernœenicus encrasicola.
Trypaphylus musteli.
Chondracanthus clavatus.
C. cornutus.
C. depressus.
C. flurae.
C. limanda.
C. soleae.

Copepoda (parasita)—*continued.*

C. zei.
Medesicaste asellinum.
Thysanote impudica.
Charopinus dalmanni.
C. ramosus.
Lernaeopoda bidiscalis.
Brachiella insidiosa.
B. ovalis.
Clavella scombri.
C. paradoxa.

CHONIOSTOMATIDAE.

Sphaeronella paradoxa.

RHIZOCEPHALA.

Peltogaster paguri.

MOLLUSCA—LAMELLIBRANCHIATA.

Neolepton obliquatum.

NUDIBRANCHIATA.

Doris pusilla.
D. repanda.
D. diaphana.
Galvina cingulata.
Hermaea dendritica.
Hero formosa.

PISCES.

Leptocephalus morrisii.
Lepadogaster decandollii.
Raia fullonica.
Callionymus maculatus.

This brings the total number of species recorded by the Liverpool Marine Biology Committee from their district up to about 2,500.

Dec. 16*th*, 1919. W. A. H.

Appendix C.

THE LIVERPOOL MARINE BIOLOGY COMMITTEE (1918).

His Excellency the Right Hon. Lord Raglan, Lieut.-Governor of the Isle of Man.
Prof. R. J. Harvey-Gibson, J.P., M.A., Liverpool.
Mr. W. J. Halls, Liverpool.
Prof. W. A. Herdman, D.Sc., F.R.S., F.L.S., Liverpool. Chairman of the L.M.B.C., and Hon. Director of the Biological Station.
Mr. P. M. C. Kermode, Ramsey, Isle of Man.
Prof. Benjamin Moore, F.R.S., London.
Sir Charles Petrie, Liverpool.
Mr. E. Thompson, Liverpool, Hon. Treasurer.
Mr. A. O. Walker, F.L.S., J.P., formerly of Chester.
Mr. Arnold T. Watson, F.L.S., Sheffield.

Curator of the Station—Mr. H. C. Chadwick, A.L.S.
Assistant—Mr. T. N. Cregeen.

CONSTITUTION OF THE L.M.B.C.

(Established March, 1885.)

I.—The Object of the L.M.B.C. is to investigate the Marine Fauna and Flora (and any related subjects such as submarine geology and the physical condition of the water) of Liverpool Bay and the neighbouring parts of the Irish Sea and, if practicable, to establish and maintain a Biological Station on some convenient part of the coast.

II.—The Committee shall consist of not more than 12 and not less than 10 members, of whom 3 shall form a quorum ; and a meeting shall be called at least once a year for the purpose of arranging the Annual Report, passing the Treasurer's accounts, and transacting any other necessary business.

III.—During the year the Affairs of the Committee shall be conducted by an Hon. Director, who shall be Chairman of the Committee, and an Hon. Treasurer, both of whom shall be appointed at the Annual Meeting, and shall be eligible for re-election.

IV.—Any Vacancies on the Committee, caused by death or resignation, shall be filled by the election at the Annual Meeting of those who, by their work on the Marine Biology of the district, or by their sympathy with science, seem best fitted to help in advancing the work of the Committee.

V.—The Expenses of the investigations, of the publication of results, and of the maintenance of the Biological Station shall be defrayed by the Committee, who, for this purpose, shall ask for subscriptions or donations from the public, and for grants from scientific funds.

VI.—The Biological Station shall be used primarily for the Exploring work of the Committee, and the Specimens collected shall, so far as is necessary, be placed in the first instance at the disposal of the members of the Committee and other specialists who are reporting upon groups of organisms; work places in the Biological Station may, however, be rented by the week, month, or year to students and others, and duplicate specimens which, in the opinion of the Committee, can be spared may be sold to museums and laboratories.

LIVERPOOL MARINE BIOLOGICAL STATION
AT
PORT ERIN.

General Regulations.

I.—This Biological Station is under the control of the Liverpool Marine Biology Committee, the executive of which consists of the Hon. Director (Prof. Herdman, F.R.S.) and the Hon. Treasurer (Mr. E. Thompson).

II.—In the absence of the Director, and of all other members of the Committee, the Station is under the temporary control of the Resident Curator (Mr. H. C. Chadwick), who will keep the keys, and will decide, in the event of any difficulty, which places are to be occupied by workers, and how the tanks, boats, collecting apparatus, &c., are to be employed.

III.—The Resident Curator will be ready at all reasonable hours and within reasonable limits to give assistance to workers at the Station, and to do his best to supply them with material for their investigations.

IV.—Visitors will be admitted, on payment of a small specified charge, at fixed hours, to see the Aquarium and Museum adjoining the Station. Occasional public lectures are given in the Institution by members of the Committee.

V.—Those who are entitled to work in the Station, when there is room, and after formal application to the Director, are :—(1) Annual Subscribers of one guinea or upwards to the funds (each guinea subscribed entitling to the use of a work place for three weeks), and (2) others who are not annual subscribers, but who pay the Treasurer 10s. per week for the accommodation and privileges. Institutions, such as Universities and Museums, may become subscribers in order that a work place may be at the disposal of their students or staff for a certain period annually ; a subscription of two guineas will secure a work place for six weeks in the year, a subscription of five guineas for four months, and a subscription of £10 for the whole year.

VI.—Each worker is entitled to a work place opposite a window in the Laboratory, and may make use of the microscopes and other apparatus, and of the boats, dredges, tow-nets, &c., so far as is compatible with the claims of other workers, and with the routine work of the Station.

VII.—Each worker will be allowed to use one pint of methylated spirit per week free. Any further amount required must be paid for. All dishes, jars, bottles, tubes, and other glass may be used freely, but must not be taken away from the Laboratory. Workers desirous of making, preserving, or taking away collections of marine animals and plants, can make special arrangements with the Director or Treasurer in regard to bottles and preservatives. Although workers in the Station are free to make their own collections at Port Erin, it must be clearly understood that (as in other Biological Stations) no specimens must be taken for such purposes from the Laboratory stock, nor from the Aquarium tanks, nor from the steam-boat dredging expeditions, as these specimens are the property of the Committee. The specimens in the Laboratory stock are preserved for sale, the animals in the tanks are for the instruction of visitors to the Aquarium, and as all the expenses of steamboat dredging expeditions are defrayed by the Committee, the specimens obtained on these occasions must be retained by the Committee (*a*) for the use of the specialists working at the Fauna of Liverpool Bay, (*b*) to replenish the tanks, and (*c*) to add to the stock of duplicate animals for sale from the Laboratory.

VIII.—Each worker at the Station is expected to prepare a short report upon his work—not necessarily for publication—to be forwarded to Prof. Herdman before the end of the year for notice, if desirable, in the Annual Report.

IX.—All subscriptions, payments, and other communications relating to finance, should be sent to the Hon. Treasurer. Applications for permission to work at the Station, or for specimens, or any communications in regard to the scientific work should be made to Professor Herdman, F.R.S., University, Liverpool.

MEMORANDA FOR STUDENTS AND OTHERS WORKING AT THE PORT ERIN BIOLOGICAL STATION.

Post-graduate students and others carrying on research will be accommodated in the small work-rooms of the ground floor laboratory and in those on the upper floor of the new research wing. Some of these little rooms have space for two persons who are working together, but researchers who require more space for apparatus or experiments will, so far as the accommodation allows, be given rooms to themselves.

Undergraduate students working as members of a class will occupy the large laboratory on the upper floor or the front museum gallery, and it is very desirable that these students should keep to regular hours of work. As a rule, it is not expected that they should devote the whole of each day to work in the laboratory, but should rather, when tides are suitable, spend a portion at least of either forenoon or afternoon on the sea-shore collecting and observing.

Occasional collecting expeditions are arranged under guidance either on the sea-shore or out at sea, and all undergraduate workers should make a point of taking part in these.

It is desirable that students should also occasionally take plankton gatherings in the bay for examination in the living state, and boats are provided for this purpose at the expense of the Biological Station to a reasonable extent. Students desiring to obtain a boat for such a purpose must apply to the Curator at the Laboratory for a boat voucher. Boats for pleasure trips are not supplied by the Biological Station, but must be provided by those who desire them at their own expense.

Students requiring any apparatus, glass-ware or chemicals from the store-room must apply to the Curator. Although the Committee keep a few microscopes at the Biological Station, these are mainly required for the use of the staff or for general demonstration purposes. Students are therefore strongly advised, especially during University vacations, not to rely upon being able to obtain a suitable microscope, but ought if possible to bring their own instruments.

Students are advised to provide themselves upon arrival with the " Guide to the Aquarium " (price 3d.), and should each also buy a copy of the set of Local Maps (price 2d.) upon which to insert their faunistic records and other notes.

Occasional evening meetings in the Biological Station for lecture and demonstration purposes will be arranged from time to time. Apart from these, it is generally not advisable that students should come back to work in the laboratory in the evening; and in all cases all lights will be put out and doors locked at 10 p.m. When the institution is closed, the key can be obtained, by those who have a valid reason for entering the building, only on personal application to Mr. Chadwick, the Curator, at 3, Rowany Terrace.

REGULATIONS OF THE EDWARD FORBES EXHIBITION.

[Extracted from the *Calendar* of the University of Liverpool for the Session 1915-16, p. 438.]

"EDWARD FORBES EXHIBITION.

"Founded in the year 1915 by Professor W. A. Herdman, D.Sc., F.R.S., to commemorate the late Edward Forbes, the eminent Manx Naturalist (1815-1854), Professor of Natural History in the University of Edinburgh, and a pioneer in Oceanographical research.

The Regulations are as follows :—

(1) The interest of the capital, £100, shall be applied to establish an Exhibition which shall be awarded annually.

(2) The Exhibitioner shall be a post-graduate student of the University of Liverpool, or, in default of such, a post-graduate student of another University, qualified and willing to carry on researches in the Manx seas at the Liverpool Marine Biological Station at Port Erin, in continuation of the Marine Biological work in which Edward Forbes was a pioneer.

(3) Candidates must apply in writing to the Registrar, on or before 1st February.

(4) Nomination to the Exhibition shall be made by the Faculty of Science on the recommendation of the Professor of Zoology.

(5) The plan of work proposed by the Exhibitioner shall be subject to the approval of the Professor of Zoology.

(6) Should no award be made in any year, the income shall be either added to the capital of the fund, or shall be applied in such a way as the Council, on the recommendation of the Faculty of Science, may determine.

(7) The Council shall have power to amend the foregoing Regulations, with the consent of the donor, during his lifetime, and afterwards absolutely; provided, however, that the name of Edward Forbes shall always be associated with the Exhibition, and that the capital and interest of the fund shall always be used to promote the study of Marine Biology."

Edward Forbes Exhibitioners.

1915	Ruth C. Bamber, M.Sc.
1916	E. L. Gleave, M.Sc.
1917	C. M. P. Stafford, B.Sc.
1918	Catherine Mayne, B.Sc.
1919	George Frederick Sleggs, B.Sc.

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APPENDIX D.

HON. TREASURER'S STATEMENT.

The Balance Sheet and List of Subscribers are shown on the following pages. It will be noticed that there is a credit balance to hand over to the Liverpool University at the end of the present year.

The following is a copy of the Minutes of the Meeting at which it was decided that the Liverpool Marine Biology Committee should be taken over by the Liverpool University:—

MINUTES OF MEETING HELD AT
MANESTY BUILDINGS, COLLEGE LANE, LIVERPOOL.

Tuesday, March 11th, 1919.

At a Meeting of the LIVERPOOL MARINE BIOLOGY COMMITTEE held as above, the following were present:

PROFESSOR W. A. HERDMAN, in the Chair.
MR. EDWIN THOMPSON, Hon. Treasurer.
MR. W. J. HALLS.
LT.-COL. R. J. HARVEY GIBSON.

1. Letters were read from Mr. A. O. Walker, Mr. P. M. C. Kermode, and Mr. Arnold T. Watson, apologising for absence, and expressing cordial agreement with the proposal to transfer the property of the LIVERPOOL MARINE BIOLOGY COMMITTEE to the University of Liverpool for the use of the Department of Oceanography.

2. It was moved by Professor Herdman, seconded by Mr. Edwin Thompson, and carried unanimously:—

> "That, considering that a Department of Oceanography (under an endowed professorship) has now been established at the University of Liverpool for the purpose of con-

tinuing and extending the work in marine biology and fisheries research which the LIVERPOOL MARINE BIOLOGY COMMITTEE was founded to promote, the Members of the Committee now assembled are of the opinion that the time has come when the intentions of the founders can best be fulfilled by handing over the vested interests and the property of the Committee, as stated in the appended Schedule, to the University on the understanding that the University, by means of the Department of Oceanography, will continue to promote higher education and research in Oceanography, including marine biology and its applications to the fishing industries, at the Port Erin Biological Station and in Liverpool; and they hereby resolve to carry out this intention forthwith, the accounts to be made up to September 30th,* 1919, and the property to be made over to the University on that date."

SCHEDULE

The lease of the Port Erin Biological Station.

The apparatus, books, chemicals, and other property of the LIVERPOOL MARINE BIOLOGY COMMITTEE at Port Erin.

The apparatus, books, etc., of the LIVERPOOL MARINE BIOLOGY COMMITTEE in the Zoological Department of the University and at the publishers.

The investments and other funds of the Committee.

3. The hope was expressed that the University would recognise the right of the scientific former Members of the LIVERPOOL MARINE BIOLOGY COMMITTEE (Mr. W. J. Halls, Professor Harvey Gibson, Professor Herdman, Mr. P. M. C.

---

* This date was subsequently, by agreement with the University, altered to December 31st.

Kermode, Professor B. Moore, Mr. Edwin Thompson, Mr. A. O. Walker, and Mr. Arnold Watson) to continue to make occasional use of the Port Erin Laboratory free of charge; and would retain the right of all the Biological Departments of the University to send Senior Students and post-graduate research workers to occupy a University "Table" at the institution.

4. It was resolved to send a copy of these Minutes to each Member of the LIVERPOOL MARINE BIOLOGY COMMITTEE and to the Vice-Chancellor of the University.

[*End of Minutes.*]

In accordance with the decision minuted above the affairs of the Committee will be taken over by the University as from January 1st, 1920.

In concluding this Statement as Hon. Treasurer may I be permitted to direct attention to the letter signed by Prof. Herdman and myself which is issued with this Report, and to express the hope that our subscribers who have done so much for us in the past will continue to give their support to the Port Erin Biological Station.

EDWIN THOMPSON,
Hon. Treasurer.

"Woodlands,"
13, Fulwood Park,
Liverpool.

December 16*th*, 1919.

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Walker, Alfred O., Ulcombe Place, Maidstone ...	3	3	0
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THE LIVERPOOL MARINE BIOLOGY COMMITTEE.

Dr. In Account with EDWIN THOMPSON, Hon. Treasurer. **Cr.**

1919.	£	s.	d.
To Printing and Stationery	28	16	4
,, Boat Hire	5	13	0
,, Books, Apparatus and Supplies at Port Erin Biological Station	17	19	7
,, Postages, Carriage, &c.	7	14	4
,, Salary—Share of Curator's	85	0	0
,, ,, ,, Assistant's	49	7	3
,, Sundries	8	8	4
,, Balance in hand, December, 1919	2	10	7
	£205	9	5

1919.	£	s.	d.
By Balance in hand, December, 1918	2	17	0
,, Subscriptions and Donations received	57	7	7
,, Amount received from Universities for hire of "Work Tables"	40	0	0
,, Laboratory Fees	5	18	8
,, Interest on British Association (1896) Fund	28	0	0
,, Interest on Investment	6	18	7
,, Sale of Guides and Post Cards	22	1	9
,, ,, Specimens, &c.	31	18	10
,, Bank Interest	10	7	0
	£205	9	5

Endowed Invested Fund:—
British Workman's Public House Co. 99 Shares
£1 each fully paid.

	£	s.	d.
Memoir Fund—Balance, as at December, 1918	212	1	7
Add Sales of Memoirs	17	2	9
	£229	4	4
Extension Fund:—Balance, as at December, 1918	£37	4	9
Board of Agriculture and Fisheries Account—			
Balance December, 1918	156	12	7
Fisheries Research Work Expenditure	65	9	1
	£91	3	6

EDWIN THOMPSON,
Hon. Treasurer.

Audited and found correct,
COOK & LEATHER,
Chartered Accountants.

Liverpool, *December 18th, 1919.*

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